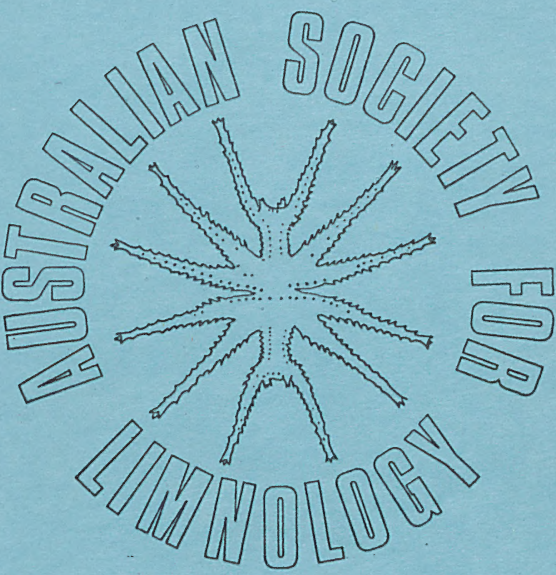
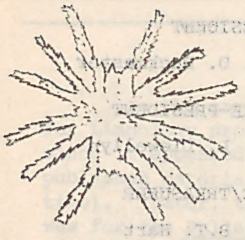


NEWSLETTER

VOLUME 15 NUMBER 1 WINTER 1977



AUSTRALIAN SOCIETY FOR LIMNOLOGY
NEWSLETTER

VOLUME 15 NUMBER 1 WINTER 1977

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THE AUSTRALIAN SOCIETY FOR LIMNOLOGY

The Australian Society for Limnology is an association of over 300 people with professional or amateur interests relating to Australian inland waters. Since its inception in 1961, the Society has played an important role in fostering limnological work in this country. The ASL also promotes liaison between limnologists in academic, private, and governmental institutions, and has a vested interest in the conservation of aquatic and related resources. Annual congresses are held near centres of limnological interest, and the program includes scientific sessions, field excursions, and social activities.

The A.S.L. produces a Newsletter, with notes on activities, articles of general and scientific interest, book reviews, and congress announcements, and an occasional Special Publication. A further periodical publication is the Directory of Australian Limnologists.

Membership applications are welcomed; four classes of subscribing membership are catered for:

- Ordinary members ($8 p.a.)
- Student members ($4 p.a.)
- Sustaining members ($50 p.a. or more)
- Affiliated Bodies (subs. on application)

NOTE: Members are entitled to receive the *Aust. J. Mar. Freshwat Res.* at a reduced rate ($4).

Subscriptions cover the period 1 July-30 June.

Details are available from:

Dr. B.T. Hart,
Hon. Sec./Treasurer, A.S.L.,
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Caulfield Institute of Technology,
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* * * * *

Newsletter contributions are always welcome, and correspondence should be addressed to the Newsletter Editor.

EDITORIAL

In the early years following formation, the Australian Society for Limnology produced a Newsletter. This was regarded as a publication since it appeared to conform to the criteria of what constituted published material (as determined by the Society's editors at that time). Later, the Society also produced a Bulletin. The intention was for the Bulletin to become the formal avenue of publication for the Society, and for the Newsletter to become a non-published document to be privately circulated within the Society's membership. To that end, all recent issues of the Newsletter have had printed on page one the following statement: "The Newsletter is not a formal publication and any material in it should not be cited without permission of the author(s) concerned".

However, with the recent cessation of the Bulletin, the Newsletter has increasingly come to include many articles of scientific merit - a trend clearly in line with the wishes of members as expressed at the Tanunda (S.A.) A.G.M. when the Editor was specifically requested to provide more "meat" in Newsletters. The question naturally follows as to the ethics of doing this when the citation of such articles is restricted. The matter came to a head when your Editor received from Dr. Ian Bayly, Monash University, a letter pointing up the problems. Dr. Bayly requested that his letter be reproduced in the next issue of the Newsletter and also be discussed at the next Congress of the Society (Lismore). The letter is reproduced below* and it was discussed at the Lismore Congress.

The result of the Congress discussion, as reported in the minutes of the A.G.M., was that "after considerable discussion the meeting decided that future articles in the Newsletter are to be considered as published and that contributors should be so warned". After the Congress, the question of exactly what did constitute publication was taken up with library staff of the Barr Smith Library at the University of Adelaide. The result left no doubt in your Editor's mind that since the Newsletter is circulated widely to members, to institutions worldwide, and to libraries, the Society's Newsletter constitutes a legitimate publication. Some extracts of relevance in this matter and kindly provided by the Library at the University of Adelaide are reproduced below:

> "1. PUBLICATION. 1. A Work (*see* WORK 1) issued to the public in the form of a document (*see* DOCUMENT 2) or book (*see* BOOK 4) (IFLA). 2. The act of issuing a book to the public (IFLA).
>
> 2. PUBLISH. 1. The action of a publisher in issuing and offering for sale to the public, a book or print produced on some kind of printing, copying or photographic reproducing machine. 2. The action of an author, artist, or composer of music, in creating something, and arranging for it to be reproduced in quantity and offered for sale.

"3. WORK. 1. Any expression of thought in language or symbols or other medium for record and communication [i.e. a work before printing or other publication] (IFLA).

4. DOCUMENT. ..... 2. Material of any kind, regardless of its physical form and characteristics, on which information has been recorded. 3. A record, usually inscribed or written, which conveys information, and which is relied on to establish facts. It is now taken to include any form of graphic, acoustic or haptic record (book, cutting, map, manuscript, drawing, periodical, etc.). 4. A work recorded in language or symbols, or by other means (*IFLA*). 5. Any form of recorded information, whether indited, alphanumeric, pictorial or auditory.

5. BOOK. ..... 4. A collection (*Fr.* assemblage) of manuscript or printed leaves fastened together to form a volume or volumes, forming a BIBLIOGRAPHICAL UNIT (*q.v.*). (It is distinct from periodicals, and from other forms of material, such as films, prints, maps, etc.)(*IFLA*). .....

Thus, this issue of the Newsletter constitutes a formal publication of the Australian Society for Limnology, and should be so regarded. Authors, intending authors, members and readers please note. Accordingly, the warning about citation has been removed from this issue and will not appear on future issues; material herein may be cited without the permission of the author(s).

It is hoped that this rationalization of printed matter issued by the Society will lead to less difficulty and "untidiness" in referring to material in the Newsletter than has been the case in the recent past.

Editorial policy, incidentally, remains the same: all material of direct or indirect interest to members of the Society will be considered for publication.

Editor.

*Letter from Dr. I.A.E. Bayly to Editor of Newsletter dated 25 April 1977.

"I have greatly enjoyed reading the articles by Buckney, Petr, Chittleborough and Timms in recent numbers [14(2 and 3)] of the A.S.L. Newsletter. However, upon reflection, I have become somewhat disquieted by the potential problems that may arise from the reproduction of these "articles" which, in their essential features (style, format, full referencing, etc.), are scientific papers.

I think I am correct in saying that when a decision was taken by the Society to discontinue the A.S.L. Bulletin, a concomitant decision was made to the effect that the Newsletter would not, from that time, take on the functions of the former Bulletin; nothing in the Newsletter was to be regarded as being published, and not only would it be marked

"for private circulation only", but the Society would see to it that only this form of circulation was actually permitted.

What concerns me is this: for a variety of reasons the authors of these Newsletter "articles" may never get around to seeing that the essential features of their contributions are properly published. The Newsletter "articles" would then become the only "available" (but strictly not available!) statement of certain material which limnologists in the future will almost certainly be very anxious to refer to and cite. At the same time future limnologists may experience considerable difficulty in obtaining permission from a dead author to do so! In these and certain other circumstances I believe that the pressure to cite, the present statement on page one about the Newsletter not being "a formal publication" not withstanding, would be overwhelming.

I am suggesting, therefore, that by reproducing these "articles" you may unwittingly be contributing to a potentially (I believe it will be actual) very difficult and "untidy" situation for both future limnologists and future librarians.

I note that the New Zealand Limnological Society avoids reproducing articles, of the type to which I have referred, in their Newsletter.

I believe, the statement at the foot of page one again not withstanding, that by the reproduction of "articles" the Newsletter is tending to take on the functions of the discontinued Bulletin.

I would request that this letter be reproduced in the next Newsletter and that the matter I have raised be discussed at the A.G.M. next month (May 1977). Unfortunately I will not be able to attend this meeting, but you will gather from what I have said that I have grave doubts about the wisdom of reproducing what are essentially scientific papers in the Newsletter and that my vote (with much regret) would be for their discontinuance.

I believe that this matter deserves careful consideration by the Society."

* * * * *

AUSTRALIAN JOURNAL OF MARINE AND FRESHWATER RESEARCH

The following statistics have been extracted from the Annual Report of the Board of Standards for Australian Journals of Scientific Research (year ending 31 December 1976).

	1976	1975	1974
Pages published	644	428	441
Published papers	43*	36	32
Rejected papers	22	7	8
Lapsed papers	15	1	1

*Includes 5 short communications (11 in 1975 and 1 in 1974)

Is the increase in papers due to the demise of the Bulletin?

GERRY PROWSE

Professor G.A. Prowse, O.B.E., of the Department of Botany, University of Hawaii, and a member of the Society, died recently. Those of us who knew Gerry will remember him as a delightful companion and a colourful personality. A sad loss.

CURRENT MEMBERSHIP

Current membership, including institutions, is 351. My God, it was *ca.* 30 just a few years ago!

* * * * *

AQUARIUM FISH AND THE IMPORTATION OF FISH

I am reliably informed that the following questions have recently been addressed to a member of the Government. If nothing else they are certainly thought-provoking.

"1. Is it possible legally to import into certain States and/or Territories of Australia more than seven hundred species of aquarium fish?

2. (a) Is it a fact that the conflicting and disparate nature of legislation renders ineffective efforts by any State or Territory to prevent the importation of any species of aquarium fish?

(b) By way of example, is it not true that Northern Territory, New South Wales and Tasmania all have written legislation prohibiting the entry of goldfish and that importers can circumvent such prohibitions simply by buying goldfish imported into (say) Victoria, Queensland or the A.C.T. and that such circumvention may have the protection of Section 92 of the Constitution?

3. Is it true that prianhas and other illegal species dangerous to man and environmentally deleterious, and on the present prohibited import list, have been and are currently being imported into Australia, and offered for sale to the public at a very low price?

4. Is it true that feral populations of aquarium fish have been found to have established themselves, especially in Queensland?

5. Is there always a thorough inspection of all aquarium fish at the point of entry into Australia to determine whether illegal species are present?

6. Are the persons who undertake such inspections of aquarium fish sufficiently well trained to be able to identify all of the species of fish that may be imported legally? If not, how many of the seven hundred species presently allowed into Australia can they reliably identify with existing facilities and in the time available? Are such inspectors also sufficiently trained, and have they the necessary equipment and facilities, to detect the organisms etc. referred to in questions 8 and 9 below?

7. Are the methods of packaging, clarity of the water, and size and maturity of the fish all adequate to permit accurate identification of all the species present?

8. Is it true that the importation of aquarium fish with accompanying water carries the attendant risk of introduction of viral, fungal, bacterial and protozoon pathogens, as well as helminth and arthropod parasites of man and domestic, native and established exotic animal species within Australia?

9. Is it also true that such introductions carry a further attendant risk of the importation of spores, seeds, eggs and juvenile stages of plant and animal species which may prove damaging to Australian primary industries and environment?

10. Given that Australia has a complete embargo on the importation of soil for any purposes, so as to avoid the introduction of the above-mentioned pathogens and undesirable material, why is it that no restrictions are applied to water which is a more suited method of transmission of the organisms, especially in regard to the short transit time associated with the international movement of live fish?

11. Why is it that in Australia (which has the record of the most effective quarantine system in the world) fish, the water in which they are carried, and the organisms which they may carry internally and externally, are allowed entry under conditions totally opposed to those conditions which apply to the entry of other living animals?

12. Is it a fact that there is no controlled supervision over the disposal of imported water from unknown sources in South East Asia, and other sources, which is directly imported to Australia and disposed of without prior treatment, yet strict controls are otherwise applied to water being imported to Australia by ship and air transport?

13. Is it true that, from the vast number of aquarium fish at present in Australia, fish breeders could if so desiring breed, under Australian conditions, future stocks of most fishes regularly imported into Australia without the risks attending importation?

14. Is it equally true that failure to do so has been occasioned by the low cost structures of the countries from which such fish are imported, resulting in low import prices allowing high profit margins?

15. If, in fact, there <u>is</u> risk to (a) the environment or (b) man or (c) any other plant or animal species through the importation of live fish and accompanying water, is this risk justifiable simply in terms of lower prices for hobbyists or higher margins for dealers than would apply if fish at present imported were bred in Australia from present stocks of species other than banned species?

16. Is it true that the importation of trout and salmon and their ova (previously imported under the strictest supervision by Government instrumentalities) has been completely banned for some years because of the risks of importation of diseases?

17. Are the waters and fishes of Australia regarded as relatively disease free? If so, should not effective measures be taken to safeguard this status, in view of the very considerable present and potential value of our disease-free aquatic fauna on the export market, in view of the valuable domestic fish farming industry, and in view of the enormous sportfishing industry so closely allied to the economy of Australia's tourist trade?"

* * * * *

CONFERENCES - RECENT AND NEAR FUTURE

1. ENVIRONMENTAL ENGINEERING CONFERENCE: The Politics, Economics and Technology of Pollution Control. Canberra, 15-17 June, 1977. Organised by The National Committee on Environmental Engineering of The Institution of Engineers, Australia.

2. THE AUSTRALIAN WATER AND WASTEWATER ASSOCIATION will be holding its 7th Federal Convention in Canberra from 21-24 September, 1977. The theme of the Convention is "Public Aspirations and Realities in Water Resources Management" and lecturers from Australia and overseas will be presenting papers on this and other aspects of water resources. Further information from Convention Chairman, Charles Speldewinde P.O. Box 359, Canberra City, A.C.T. 2601.

3. SYMPOSIUM - AQUATIC RESEARCH IN SOUTHERN QUEENSLAND. Conducted by the Department of Biology and Environmental Science, Queensland Institute of Technology.

VENUE: 22-23 September, 1977. Parkroyal Motor Inn, Cnr. Alice & Albert Street, Brisbane.

PURPOSE & OBJECTIVES: The symposium is intended
(a) to promote discussion of ideas and problems by a diversity of specialists concerned with freshwater, its biota and uses,
(b) to define areas of current activity and interest in freshwater biology and ecology, and
(c) to stimulate, where desirable, co-operative or co-ordinated investigation of aquatic organisms, ecosystems and resources in southern Queensland.

PROGRAM: The two-day program will be divided in four SESSIONS, commencing with papers of broad scope and general nature (e.g. ecosystem studies, management problems) and progressing to more specific studies (e.g. on particular groups of organisms).

DAY 1

MANAGEMENT
- Eutrophication in south-east Queensland W.A. Dodd
- Wivenhoe Dam Project W. Solly
- Control of submerged aquatic weeds in irrigation channels A.C. Julian
- Biological control, an approach to the control of water hyacinth W. Forno
- Uptake of nutrients by emergent aquatic plants J.M. Lovett, J.S. Weir
- The assessment of water weed problems D.S. Mitchell
- Vegetation rehabilitation: Theory and practice in urban riverine parkland systems R.A. Hynes

WATER TREATMENT / WATER QUALITY

- Some problems experienced in the operation of water treatment plants servicing a major urban area R.F.R. Williams
- Summary of alum recovery pilot plant operations at the Brisbane River Treatment Works R.F.O. Woolley
- Studies in the use of dissolved air flotation on North Pine Water G.W.P. Goss
- Determination of the bactericidal efficiency of chlorine on *Escherichia coli* and *Klebsiella pneumoniae* D.D. Walker
- Incidence of Salmonellae in sewage and stream samples R.G. Foy
- Variations in water and sediment quality for Oxley Creek, 1974-75 E. Stock
- Some factors affecting water quality of the Condamine River C.W. Ross

DAY 2

LIMNOLOGY

- Atkinson Dam Project H. Yezdani
- The trophic status of the North Pine River Dam J. Wilson, C. King
- Ecological studies of Queensland dune lakes A.H. Arthington
- Microbiological studies of dune lakes A.H. Arthington, G. Lee-Manwar
- Some aspects of the present and past ecology of a unique perched lake on Fraser Island A.G. Elliott, R.H. Coutts, M.E. McCallan, G.M. Proud

POLLUTION

- The Bulimba Creek aquatic ecosystem investigation D.W. Connell, A.H. Arthington, S. Easteal
- The effects of chemical sprays used in water hyacinth control on *Velesunio* sp. D. Warmington
- Environmental implications of petroleum hydrocarbons in the Brisbane River estuary G.J. Miller, D.W. Connell

BIOLOGY

- The occurrence and determination of phytoplankton in the Brisbane catchment areas E.H. Ferguson
- Studies on periphyton on aquatic macrophytes L.G. Cook
- A preliminary study of the benthic macroinvertebrates of Bulimba Creek T.S. Hailstone
- Studies on the reproduction and reproductive behaviour of the freshwater prawn *Macrobrachium australiense* Holthius, 1950 (Decapoda: Palaemonidae) C.L. Lee
- A study of the bulkuru sedge *Eleocharis dulcis* (Burm. F.) Trin in relation to the brolga *Grus rubicundus* (Perry) J. Powell, G. Blackman

CORRESPONDENCE TO THE CONVENOR: Mr. B.J. McMahon, Department of Biology and Environmental Science, Queensland Institute of Technology, P.O. Box 246, NORTH QUAY, QLD. 4000.

4. CONFERENCE ON AGRICULTURAL ENGINEERING, 1978: Toowoomba, 21-24 August, 1978.

CALL FOR PAPERS

THE CONFERENCE: This conference will be held in Toowoomba, 21-24 August 1978. It will be organised by the National Committee on Agricultural Engineering of The Institution of Engineers, Australia.

PAPERS: The conference will be concerned with the whole field of Agricultural Engineering. Papers are invited in particular in the following areas:

SOIL AND WATER

*Hydrology
Irrigation
Soil Conservation
Drainage
*River Improvement
Soil-Water-Plant Relationships
Land Use Planning

*STRUCTURES AND ENVIRONMENT

Environment Control for Crop and Animal production
Waste Treatment and Utilisation
Animal Housing
Agricultural Buildings

POWER AND MACHINERY

Tillage
Traction
Crop Protection, Harvesting, Handling, Processing and Distribution
Properties of Agricultural Materials
Energy Systems

EDUCATION

Intending authors should submit the titles of proposed papers together with a brief synopsis (not more than 250 words) outlining the aims, content and conclusions of their papers. Synopses must be received by 30 September 1977, and should be accompanied by a statement of the authors' intention to attend the Conference.

Authors will be notified of the provisional acceptance of their papers by 31 October 1977. They will then be asked to submit the full text of papers by 28 February 1978, for final consideration. Accepted papers will be pre-printed by the photo-offset process direct from authors' manuscripts and will be circulated to registrants prior to the conference.

POSTERS: As an alternative to the formal presentation of papers, authors may elect to prepare their papers as posters.

DEADLINES: Intending authors should note the following deadline dates:

For Papers	
Receipt of synopses	30 September 1977
Notification of provisional acceptance to papers	31 October 1977
Receipt of full text for final review	28 February 1978

FURTHER INFORMATION: The final programme will be available in May 1978 and will include the Registration Form and all details of the Conference.

ENQUIRIES: All correspondence relating to the Conference and proposals for papers should be addressed to: The Conference Manager, Conference on Agricultural Engineering, 1978, The Institution of Engineers, Australia, 11 National Circuit, BARTON, A.C.T. 2600. Telephone: (062)73 3633 Telegrams: ENJOAUST, Canberra.

SCIENCE CREATES A DESERT FLUSH

"There are a few lines of unusual small print on the lavatory cisterns at the Dead Sea camp sit at Ein Gedi: "For full service - pull to the right. For half-service - pull to the left...".

The cistern flushing system is a water-saving device that is likely to become a common fixture around the world. But at the moment the "Beersheba Toilet" is a major attraction for tourists at Ein Gedi and the basis of a string of scatalogical jokes.

This new, dual-flush system is a remarkably simple water-saving device which, when it has been installed in every home in Israel, will save more than 30 million cubic metres a year of precious water.

Part of a major national research program to conserve water, the "Beersheba Toilet" was developed to cut down excessive consumption of domestic water by a wide variety of devices.

Developed by Dr. Zeev Raz of Ben Gurion University, the dual-flush system uses an air bell that releases either four or 9.5 litres of water, depending on which lever is pulled.

It is simple, inexpensive (about $5) and relatively easy to install. The water-saving distributor comes in a single, small box a few inches square which can be placed inside any time of cistern with a syphon, float valve or other type of mechanism. Any home owner can convert his existing cistern into a dual flush system or modifications can be carried out at the factory."

[From a newspaper article]

* * * * *

CREATING A HELL OUT OF THE ENVIRONMENT

"Many Americans, particularly businessmen involved in environmental issues, have become alarmed at the bureaucratic structures which have burgeoned in the cause of environmental protection. A columnist, Erma Bombeck, writing in the Santa Monica Evening Outlook, delivered a satirical attack on this development with this item:

IN THE BEGINNING GOD CREATED HEAVEN AND EARTH. He was then faced with a class action suit for having failed to file an environmental impact statement with the Heavenly Environmental Protection Agency (HEPA, an angelically-staffed agency dedicated to keeping the Universe pollution-free). God was granted a temporary permit for the Heavenly Portion of the project but was issued a cease-and-desist order for the Earthly part, pending further study by HEPA.

Then God said, "LET THERE BE LIGHT" and He should never have brought up this point since one of the council was active in Sierrangel Club and immediately demanded to know how the light would be made. Would there be strip-mining? How about thermal pollution? Air

pollution? God explained the light would come from a huge ball of fire.

Nobody in council really understood this, but it was provisionally accepted assuming (1) no smog or smoke would result from the ball of fire; (2) a separate burning permit would be required, and (3) since continuous light would be a waste of energy it should be dark at least half the time. God agreed. When asked how the Earth would be covered for darkness, God said, "LET THERE BE FIRMAMENT AMIDST THE WATERS" and one ecologically radical council member accused him of doubletalk, but action was tabled since God would be required first to file for permit from Angelic Bureau of Land Management (ABLM) and further would be required to obtain water permits from appropriate agencies.

God said, "LET THE WATERS BRING FORTH THE CREEPING CREATURES HAVING LIFE AND THE FOWL THAT MAY FLY OVER THE EARTH". Here again, council took no formal action, since it would require approval of the Game and Fish Commission, coordinated with Heavenly Wildlife Federation and Audubongelic Society.

Everything appeared in order until God said He wanted to complete the project in six days. At that point he was advised by council that his timing was completely out of the question. HEPA would require a minimum of 180 days to review the application and impact statement. After that, there would be public hearings. It would be 10 or 12 months before a permit could be granted.

God said, "To Hell with it." "

(From *Environmental Control News*)

* * * * *

AQUATIC WEEDS IN S.E. ASIA. PROCEEDINGS OF A REGIONAL SEMINAR ON NOXIOUS AQUATIC VEGETATION, NEW DELHI, 12-17 DECEMBER, 1973.

EDITED BY C.K. VARSHNEY AND J. RZOSKA

Dr. W. Junk b.v., Publishers. The Hague, The Netherlands, 1976, 396 pp., Dutch Guilders 110.-.

REVIEWED BY T. PETR, OFFICE OF ENVIRONMENT AND CONSERVATION, WAIGANI, PAPUA NEW GUINEA

South-East Asia is a region with frequent problems of mass appearance of aquatic weeds. The wide use of irrigation enhances the proliferation of water weeds, resulting in major socio-economic problems. The Proceedings of a seminar organized on this topic in India in 1973 contain 51 papers, most of them dealing with the Indian scene.

The aim of the Seminar can be summarized as: monitoring, management, control measures and utilization of problem aquatic plants. Only very few papers are of fundamental character (distribution of aquatic weeds, *in vitro* cultures, modelling). One paper reviews the distribution of aquatic weeds in the tropics and subtropics, another paper reviews the aquatic weed problems in India. One paper deals with Thailand, two papers each cover Kashmire, Indonesia and Sri Lanka. The majority of papers deal with India, but Gaudet discusses the *Salvinia molesta* infestation on Lake Naivasha in Kenya (p. 193-209). We have an excellent review by Mitchell (p. 167-176) on *Salvinia* and *Eichhornia*. Gopal (p. 177-181) emphasizes that *S. molesta* does not occur wild in North Central India (Punjab, Haryana, Delhi, Uttar Pradesh, Bihar, Rajastan and Madhya Pradesh) and this shows how its distribution is limited by low temperatures. Kashmir has *S. natans* (Kaul *et al.*, p. 79-83; Kaul & Bakaya, p. 183-192), and Sri Lanka has *S. auriculata* (Dassanayake, p. 59-61; Kotalavala, p. 51-58 - and here I believe the taxonomical status can be questioned). *S. cucculata* is present in Andhra Pradesh and in Thailand (Chomchalow & Pongpangan, p. 43-50) and in Indonesia, where it occurs together with *S. molesta*. This last species is also a great menace in Kerala, South India. *S. molesta* has not yet been recorded from Bangla Desh and from Pakistan (Robson, p. 25-30). *S. auriculata* in the title of the paper by Sankaran (p. 323-329) should clearly read *S. molesta*, as he uses the latter name throughout the text.

Indonesian man-made lakes seem to have no problems with aquatic weeds (Soerjani, p. 63-78). It appears that the new Indonesian reservoirs have not experienced the explosive aquatic plant growth that some African man-made lakes have experienced.

Reading through the contributions one becomes repeatedly aware of the fact that *Eichhornia crassipes* (water hyacinth) and *Salvinia* spp. are the two dominant noxious weeds of South-East Asia. The rate of growth of *E. crassipes* is approximately 500 kg $ha^{-1}day^{-1}$. No wonder so much effort is spent on finding out what to do with such an efficient producer of organic matter. Kotalavala suggests that industrial use of aquatic plants is the only way to offset the cost of mechanical control which is considered by the author to be the best way of controlling aquatic weeds under present conditions. Five papers deal with mechanical control, and seven papers with chemical control of aquatic weeds. The benefits of weeds are spelled out by a number of authors, and it is a matter of interest to see that the nutritional values of water hyacinth and *Hydrilla* compare favourably with that of Bermuda grass *(Cynodon dactylon)*. Three kilograms of the dry processed feed from these weeds would satisfy the daily intake requirements of a 450 kg steer (Frank, p. 353-359). Mitra & Banerjee (p. 375-381) recommend *Eichhornia* compost for its relatively high nutrient concentration, and certainly experiments showed that *E.*compost spread in water resulted in much higher zoo- and phytoplankton production than compost from *Hydrilla* or *Spirodella*. One author disputes the usability of *Eichhornia* for making paper (water hyacinth does not contain cellulose), but Nag (p. 383-385) managed to make paper from it (he does not say how) and he is confident that a fine quality paper could be produced on a commercial scale. We also learn that the same plant can be used as food after removing salts of oxalic acids. Nag believes that proper utilization of water hyacinth will not only clear the water bodies but may contribute to the economic uplift of India. Another plant of economic promise is *Scirpus lacustris* which can be used to check bacterial growth in water works and to remove phenol from industrial wastes (Zafar, p. 387-391).

A number of papers deal with biological control, and a good review presented by Allen (p. 299-306) deals with insect control of *Alternanthera philoxeroides* (alligator weed), *Eichhornia crassipes*, *Myriophyllum spicatum* and *Hydrilla verticillata*. The target pests have been tested at the University of Florida, which had comparative research programmes in Pakistan, Malaysia and Vietnam. Biological control of *Salvinia* and *Eichhornia* by insects is discussed by Sankaran (p. 323-330), and control of *Hydrilla* by fish by Raj (p. 335-339). Two insects, *Aphis* sp. and *Nymphula* sp., have been found to be natural enemies of *Hydrilla* (Varghese & Gurchan Singh, p. 341-352). The impact of grass carp is discussed in two papers (p. 307-322).

Due to the large number of papers devoted to similar topics, some repetitions, overlaps and controversies occurred. And on p. 49 we learn that "Amazonian manatees prefer water temperature around 25-30^{o} and an air temperature a little warmer (20-25^{o}C)".

The Seminar did not include the problem of aquatic weeds as a habitat for vectors of parasitic diseases. One paper seems out of context, as it deals with marine algae of a coastal brackish water body (Radhakrishnan, p. 107-117).

At least two points of interest should not be missed: domestic buffaloes are considered the best carriers of the weeds from pond to pond (Misra, p. 103-106). And the submerged weeds *Hydrilla verticillata*, *Valisneria spiralis*, *Potamogeton pectinatus* and *Typha angustata* have caused interference with pilgrim bathing in a river (Dutta & Gupta, p. 249-252).

AQUATIC VEGETATION AND ITS USE AND CONTROL

EDITED BY D.S. MITCHELL

A contribution to the International Hydrological Decade, 1974, Unesco, Paris, 135 pp.

REVIEWED BY T. PETR, OFFICE OF ENVIRONMENT AND CONSERVATION, WAIGANI, PAPUA NEW GUINEA

This is an excellent review booklet of high standard. The content is organized under the following major headings: Water weeds (identification, environmental requirements); The normal role of vegetation in water; The development of excessive populations of aquatic plants; The effects of excessive aquatic plant populations; Environmental management in relation to aquatic weed problems; The control of aquatic weeds: mechanical, chemical, biological; Utilization of aquatic plants; An appraisal of the problem of aquatic weeds.

* * * * *

AQUATIC WEED IDENTIFICATION AND CONTROL MANUAL

ANONYMOUS

Published by (and available from) Bureau of Aquatic Plants Research and Control, Florida Department of Natural Resources, Larson Building, Tallahassee, Florida, U.S.A., 100 pp., $US2.50 (in 1974) [No date, perhaps 1973]

REVIEWED BY T. PETR, OFFICE OF ENVIRONMENT AND CONSERVATION, WAIGANI, PAPUA NEW GUINEA

Apart from its concise form, this publication is remarkable for its excellent colour photographs. It includes a brief account of preventive measures, control techniques, it elaborates the chemical control, gives lists of chemicals, dilutions for use, their application, advantages and disadvantages. The rest (80 pages) is the description of individual 'pests' and how to deal with each of them. I consider this book superior to anything I have seen produced on this topic in Australia and elsewhere.

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HANDBOOK OF UTILIZATION OF AQUATIC PLANTS

E.C.S. LITTLE

A compilation of the world's literature, 1968, FAO, Rome, Crop Protection Branch, 123 pp.

This is a collection of 49 papers published between 1918 and 1967 and organized under the following headings: The water hyacinth (35 papers); Other aquatic plants (14 papers). This publication is still good value.

* * * * *

The following is based upon a report submitted by Dr. Hart of research in progress at the Caulfield Institute of Technology.

1. PROJECT TITLE: Determination of the Chemical Forms of Selected Heavy Metals in Natural Waters and Wastewaters

OBJECTIVE OF PROJECT: To provide information on the distribution and chemical forms of selected heavy metals in natural waters and in aqueous effluents, and to determine the main factors controlling the distribution of the particular chemical forms in the Australian aquatic environment.

DESCRIPTION OF PROJECT: Detailed methodological investigation has been undertaken to determine the usefulness of techniques such as membrane filtration, ultrafiltration, dialysis, ion-exchange using Chelex-100, and anodic stripping voltammetry. A suitable methodology has now been developed to allow several physico-chemical forms of the trace metals Cd, Cu, Pb, Zn, Fe and Mn to be determined. A number of Victorian rivers and lakes have been surveyed. Multicorrelation analyses are being attempted, using the trace metal forms and environmental parameters such as pH, common anions and cations, suspended solids, dissolved and total organic carbon. It is hoped that this latter analysis will identify the main parameters controlling the distribution of trace metal forms.

SUBJECT INDEX TERMS: HEAVY METALS, SPECIATION, PHYSICO-CHEMICAL FORMS, CADMIUM, COPPER, LEAD, ZINC, IRON, MANGANESE

WATER RESOURCES RESEARCH SUB-CATEGORY: 05B

COMMENCEMENT DATE: September 1974 COMPLETION DATE: June 1977

SUPERVISOR: B.T. Hart, Ph.D., Acting Head, Chemistry Dept. (25%)

PROJECT STAFF: S.H.R. Davies, B.Sc., Research Officer (100%)

2. PROJECT TITLE: Heavy Metals in Waters and Sediments from the Albury-Wodonga Study Area

OBJECTIVE OF PROJECT: To determine the transportation, accumulation and remobilisation mechanisms for heavy metals in the River Murray in the vicinity of Albury-Wodonga.

DESCRIPTION OF PROJECT: Regular sampling of waters from the River Murray, Kiewa and Ovens Rivers, Lake Hume and Lake Mulwala, at approximately two-monthly intervals, has taken place. Samples were analysed for Fe, Mn, Cd, Cu, Pb and Zn. Some samples were also analysed for Hg. Data have been used to determine the main trace metal transportation mechanisms through the systems. Sediments have also been taken from the

three rivers and the two lakes mentioned above, and from a number of billabongs in the region. These samples were also analysed for the above metals, and in addition have been analysed for organic content and sand, silt and clay fractions. The data have been used to identify the areas in the system where trace metal accumulation is occurring. Further studies of the mechanisms for trace metal accumulation in Lake Mulwala and a number of billabongs is in progress. A special survey is also underway to determine the levels and forms of Fe, Mn, Cd, Cu, Pb and Zn in Lake Hume during stratification.

SUBJECT INDEX TERMS: HEAVY METALS, SEDIMENTS, RIVERS, LAKES, BILLABONGS, HEAVY METAL TRANSPORTATION, ACCUMULATION AND REMOBILISATION

WATER RESOURCES RESEARCH SUB-CATEGORY: 05B

COMMENCEMENT DATE: January 1975 COMPLETION DATE: December 1977

SUPERVISOR: B.T. Hart, Ph.D., Acting Head, Chemistry Dept. (2%)

PROJECT STAFF: R.G. McGregor, Dip.App.Chem., Technical Officer (10%)

3. PROJECT TITLE: Nutrient Status of Lake Mulwala Sediment

OBJECTIVE: To determine the amounts and forms of phosphorus in sediments from Lake Mulwala and relate this to possible accelerated phytoplankton or macrophyte growth.

DESCRIPTION OF PROJECT: Sediments have been taken from Lake Mulwala, a man-made lake downstream from the Albury-Wodonga growth centre. Total-phosphorus levels were found to be dependent upon position in lake, sediment, organic matter and water depth. Work is in progress to determine the relative proportions of a number of forms of phosphorus in these sediments. Our intention is to develop a chemical test to measure the amount of phosphorus "available" to algae. This will then be used as a management tool to assess the potential of these sediments to cause eutrophication in the overlying lake waters.

SUBJECT INDEX TERMS: LAKES, PHOSPHORUS FORMS, EUTROPHICATION, NUTRIENTS

WATER RESOURCES RESEARCH SUB-CATEGORY: 05B, 05C

COMMENCEMENT DATE: August 1975 COMPLETION DATE: 1979

SUPERVISOR: B.T. Hart, Ph.D., Acting Head, Chemistry Dept. (2%)

PROJECT STAFF: I.C. Campbell, M.Sc., Biology Lecturer, C.I.T. (2%)
R.G. McGregor, Dip.App.Chem., Technical Officer (5%)

4. PROJECT TITLE: Fate of Heavy Metal Transport to Estuaries by Fluvial Systems

OBJECTIVE OF PROJECT: To investigate the fate of heavy metals transported to estuaries by fluvial systems.

DESCRIPTION OF PROJECT: This project consists of four inter-related subprojects, which are:

i) an investigation of the levels of heavy metals in the sediments of the Latrobe River and Lake Wellington, Vic.

ii) an investigation of the sorption dynamics of trace metals between sediment material and aqueous solutions as influenced by a number of variables, particularly including salinity and pH

iii) characterisation (chemically and mineralogically) of the suspended material transported by fluvial systems, and investigation of the sorption dynamics of trace metals between sediment material and aqueous solutions as influenced by a number of variables

iv) an investigation of the influence of environmental variables on the levels and forms of heavy metals in interstitial waters in estuarine sediments.

At present we are investigating the trace metals cadmium and zinc

SUBJECT INDEX TERMS: HEAVY METALS, FATE, TRANSPORTATION, SORPTION, ESTUARIES, FLUVIAL SYSTEMS

WATER RESOURCES RESEARCH SUB-CATEGORY: 05B

COMMENCEMENT DATE: May 1975 COMPLETION DATE: 1979

SUPERVISORS: R. Beckett, Ph.D., Lecturer, Chemistry Dept. (5%)
B.T. Hart, Ph.D., Acting Head, Chemistry Dept. (2%)

PROJECT STAFF: I. McKelvie, Dip.App.Chem., M.App.Sci. candidate (100%)
M. Ellaway, Dip.App.Chem., M.App.Sci. candidate (100%)
R.G. McGregor, Dip.App.Chem., Technical Officer (5%)

5. PROJECT TITLE: Forms of Phosphorus in Sediments and Interstitial Waters from Three Maar Lakes in Western Victoria

OBJECTIVE OF PROJECT: To determine the forms of phosphorus in sediments and interstitial waters from three Maar Lakes in Western Victoria, and to identify the factors influencing the exchange of phosphorus between the sediments and the water column.

DESCRIPTION OF PROJECT: Three maar lakes near Camperdown, in Western Victoria (Lakes Purrumbete, Bullenmerri and Gnotuk), represent an ideal field system for studying the influence of salinity on phosphorus cycling. These lakes are similar in many respects (e.g. size and depth) but differ markedly in salinity; Lake Purrumbete is fresh (~400 mg/l), Lake Bullenmerri slightly saline (~8000 mg/l) and Lake Gnotuk saline (~58000 mg/l).

Sediment cores will be taken from these lakes, the interstitial waters squeezed from them and analysed. It is intended that ultrafiltration will be used to provide a broad separation of the phosphorus fractions.

Some laboratory experiments involving ^{32}P will be undertaken, to measure exchange rates of phosphorus between sediments and overlying waters under a number of different environmental conditions.

SUBJECT INDEX TERMS: PHOSPHORUS FORMS, SEDIMENTS, INTERSTITIAL WATER, SEDIMENT-WATER INTERFACE, EUTROPHICATION, NUTRIENTS

WATER RESOURCES RESEARCH SUB-CATEGORY: 05B

COMMENCEMENT DATE: March 1977 COMPLETION DATE: 1979

SUPERVISOR: B.T. Hart, Ph.D., Acting Head, Chemistry Dept. (2%)

PROJECT STAFF: P. Kew, B.Sc., Lecturer, Warrnambool Institute of Advanced Education (50%)

6. PROJECT TITLE: Identification of Natural Organic Compounds in Australian Freshwater Systems

OBJECTIVE OF PROJECT: To isolate and identify the major natural organic compounds present in selected Australian freshwater systems, and to study their ability to complex with trace metals.

DESCRIPTION OF PROJECT: Fulvic acids have been found to dominate the organic compounds isolated from overseas freshwater systems. Little is known of the amounts or types of natural organics present in Australia. We expect the dominance of eucalyptus species in many Australian forests to contribute organic compounds somewhat different to those found in Northern Hemisphere streams. Certainly there would appear to be a more even annual pattern of organics entering Australian streams compared with the Northern Hemisphere, where a very large influx occurs as a result of the leaf fall at autumn time. The influence of these factors on trace metal mobilisation is unknown, and will be the subject of our study.

Three streams will be investigated; Redwater and Clearwater Creeks in the Ottway Ranges and Slip Creek, which drains the control catchment of the M&MBW's Coranderrk Creek Experimental Catchment near Healesville.

SUBJECT INDEX TERMS: ORGANIC COMPOUNDS, FULVIC ACID, HUMIC ACID, COLOUR

WATER RESOURCES RESEARCH SUB-CATEGORY: 05B

COMMENCEMENT DATE: February 1977 COMPLETION DATE: 1979

SUPERVISORS: B.T. Hart, Ph.D., Acting Head, Chemistry Dept. (2%)
D.G. Hewitt, Ph.D., Senior Lecturer, Chemistry Dept. (2%)

PROJECT STAFF: R. Fisher, B.App.Sci., M.App.Sci. candidate (100%)

7. PROJECT TITLE: A Study of the Chemical and Biological Changes in Sewage Lagoons

OBJECTIVE OF PROJECT: To determine the chemical and biological changes occurring in a sewage lagoon system with a view to developing improved techniques for managing these systems.

DESCRIPTION OF PROJECT: A recently commissioned three-stage lagoon system at Cranbourne has been selected for study. Regular sampling throughout the system is taking place. Samples are being analysed for the following chemical parameters: BOD, TOC, suspended solids, chlorophyll a, Kjeldahl-N, NO_3-N, NH_3-N, total-P and PO_4-P. Algal counts and species types are also being undertaken.

SUBJECT INDEX TERMS. SEWAGE TREATMENT, OXIDATION LAGOONS, ALGAE NUTRIENTS

WATER RESOURCES RESEARCH SUB-CATEGORY: 05D

COMMENCEMENT DATE: February 1977 COMPLETION DATE: December 1977

SUPERVISORS: I.C. Campbell, M.Sc., Lecturer, Biology (5%)
B.T. Hart, Ph.D., Acting Head, Chemistry Dept. (2%)

PROJECT STAFF: D. Hamerton, B.Eng., Post-graduate student
G. Eccelston, Dip.App.Chem., Post-graduate student

Some reports and publications which are either in preparation, submitted or published concerning the above projects are:-

B.T. Hart: Trace Metal Survey of Waters in the Albury-Wodonga Area. Water Studies Centre Technical Report No. 2, February 1976.

B.T. Hart: Trace Metal Survey of Waters in the Albury-Wodonga Area, Report No. 2. Water Studies Centre Technical Report No. 4. March 1977.

B.T. Hart: Survey of Trace Metals in Sediments from the Albury-Wodonga Area. Water Studies Centre Technical Report No. 5, March 1977.

B.T. Hart, R.G. McGregor and W.S. Perriman: Nutrient Status of the Sediments in Lake Mulwala, I, Total Phosphorus. *Aust. J. Mar. Freshwat. Res.* 27, 129-135 (1976).

B.T. Hart and S.H.R. Davies: A New Dialysis-Ion Exchange Technique for Determining the Forms of Trace Metals in Water. *Aust. J. Mar. Freshwat. Res.* 28, 105-112 (1977).

B.T. Hart and S.H.R. Davies: A Batch Method for Determining Ion-Exchangeable Trace Metal Fractions in Natural Waters. *Aust. J. Mar. Freshwat. Res.* (Accepted for publication in 1977)

B.T. Hart and S.H.R. Davies: Physico-chemical Forms of Trace Metals at the Sediment-Water Interface. To be published in Proceedings of UNESCO/SIL Symposium "Interactions between Sediments and Water", Amsterdam, September 1976.

S.H.R. Davies and B.T. Hart: Forms of Heavy Metals in Secondary Sewage Effluents and Changes in these Forms when Effluents are Discharged to a Receiving Water. Paper to be presented at the 7th Federal Convention, AWWA, Canberra, September 1977.

B.T. Hart: Forms of Heavy Metals in Rivers, Lakes and Reservoirs - Implications for Water Quality Criteria. Paper to be presented at the 7th Federal Convention, AWWA, Canberra, September 1977.

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XVI CONGRESS, LISMORE, MAY 1977

Members who were unable to make the journey to Lismore missed out on an excellent Congress. The scientific content was excellent; the company good; and the hospitality first-rate. Our thanks go to John Lake for taking on the burden of organizing the conference. Thanks, too, to Nola Lake for a splendid barbecue. The programme in brief:

Friday, 20 May:	Registration and executive committee meeting
Saturday, 21 May:	Scientific papers, Presidential address, A.G.M., Annual dinner
Sunday, 22 May:	Scientific papers, excursion to Whian Whian and barbecue at "Lakes Lodge" (including a sandwich lunch on bus; visit to "The Pottery", where potting and weaving was demonstrated; visit to relict rainforest area and adjacent rainforest creek and falls; visit to Rocky Creek Dam; followed by a late-afternoon barbecue at "Lakes Lodge", executive committee meeting.
Monday, 23 May:	Field trip to Ainsworth and Taylor's Lakes (dune lakes in Lennox Head area) led by Dr. B.V. Timms.

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XVI ANNUAL GENERAL MEETING

Northern Rivers College of Advanced Education, May 21, 1977

MINUTES

1. Adoption of Agenda. An agenda for the meeting was circulated and modified by transferring Item 14(b)(IV) for discussion after Item 10, Report of Jolly Award Committee.

2. Apologies were received from F. Reynolds, K. Walker, M. Geddes, P. Suter, R. Croome, F.G. Wraight, I. Bayly, J. Glaister, D. Francois, D. Thomas, D. Cannon, T. Hillman, B. Mills, D. Lynch, A.D. Butcher, G. Brand, A. Neboiss, J.H. Block, E. Friese, I. Potter, B. Smith, I. Hiscock, V. Jones, M. Keough, D. Coombe, T. Petr, J. Glover, S. Hussainy, N. Milward, L. MacMillan, A. Simmonds, J. Powling.

3. Minutes. Minutes of the previous AGM were circulated to members prior to the meeting. These were duly accepted.

4. Correspondence. Secretary-Treasurer tabled correspondence and pointed out that all matters requiring attention were listed under General Business. A letter received that day concerning sand mining in the Cooloola area of Queensland was deferred for consideration to the next Executive meeting.

5. President's Report. Dr. Pollard spoke of plans to incorporate the Society's Project Aqua list into a list of sites for the National Heritage Commission and outlined progress made to date. He spoke of the policy to increase the scientific content of the Newsletter to counteract the loss of the Bulletin and suggested that the Society might think of circulating the Newsletter more widely. He spoke of the need to tighten construction and grammar in the Constitution and of the Committee's desire to establish an Educational Sub-committee to formulate Society policy in education. He drew attention to a consulting service set up by the American Fisheries Society, suggesting that ASL should consider such a matter.

6. Secretary-Treasurer's Report. Dr. Buckney summarised the Society's business for the year. He asked members to be active in recruiting new members since these provide extra income for the Society without adding greatly to the expenditure.

The Financial Statement was circulated prior to the meeting together with Membership Statistics. A summary of these follows.

FINANCE

GENERAL A/C	INCOME	EXPENDITURE	
Receipts	2581.63	Expenses	2797.69
Balance 30/4/76	750.97	Balance 12/5/77	534.91
	3332.60		3332.60

PUBLICATIONS A/C			
Receipts	2036.36	Expenses	365.75
Balance 30/4/76	437.60	Balance 12/5/77	2108.21
	2473.96		2473.96

JOLLY AWARD A/C	
Balance	131.07

Membership

New Members	39	Institutional Members	58
Total No.	273	Sustaining Members	2
Resignations	5		

7. Honorary Auditor's Report. A letter from F. Reynolds was read certifying that the Society's finances were in order, and recommending that the Society establish formal and continuing account books so that more detailed description of finances can be kept.

8. Editorial Committee Report. Secretary-Treasurer outlined correspondence regarding the publication of the work on the Morphometry of Tasmanian Lakes. A cover design is to be approved by Dr. Hiscock.

Prof. Williams reported on plans to print a key to the Stoneflies of Victoria by H.B.N. Hynes. The meeting approved this proposal.

President called for ideas for future publications to be sent to the new Committee.

9. Newsletter Editor's Report. Prof. Williams read a letter from Dr. Bayly concerning the fact that articles in the Newsletter are not formal publications and questioning the wisdom of permitting an increase of scientific content without reviewing this policy. The letter will be published in the Newsletter.

After considerable discussion the meeting decided that future articles in the Newsletter are to be considered as published and that contributors should be so warned. Acceptance of papers to be at the Editor's discretion.

Prof. Williams suggested that it may be in the Society's interests to change the Newsletter Editor. The meeting felt that there should be no change for a further year.

10. Report of the Jolly Award Committee. Mr. Wharton explained the basis of Jolly Award and announced W. Williams as recipient for 1976/77. He then delivered biographical details of Prof. Williams.

11. Venue for XVII Congress. The following sites were offered:

Albury/Wagga-Riverina CAE	(K. McKenzie)
Broken Hill-Menindee Lakes	(L. Llewellyn)
Q.I.T.	(G.H. Yezdani)

The meeting felt that Menindee Lakes would be best. This matter needs to be considered further by new Committee.

12. Election of Office Bearers. The following were duly elected.

(Dr. Pollard takes an ex-officio position)

President	D. BUCKMASTER
Vice-President	L. LLEWELLYN
Secretary/Treas.	B. HART (elected the following day)
Committee	(1) Arthington
	(2) Cheng
	(3) Shearer
	(4) Barclay
	(5) McKenzie
	(6) Fletcher
	(7) Yezdani
	(8) R. Williams

13. Appointment of Honorary Auditor. W.D. Williams was appointed to this position.

14. Annual Subscription. Secretary-Treasurer recommended no increase in subscription.

The subscription rates are:

Full members (ordinary and institutional)	$8.00
Student members	4.00

Subscription to AJMFR extra.

15. General Business

(a) Arising from XV A.G.M.:

(i) Contact with Schools: Jef Clark agreed to establish a sub-committee to look into the role that A.S.L. might play in science education.

(ii) Project Aqua. It was resolved that I. Campbell was to pursue this matter further and to produce a list for the whole of Australia.

(iii) N.Z. meeting. Dr. Buckney reported that he, P. Tyler, and R. Marchant had attended the NZCS meeting and conveyed ASL's compliments. An Australia, L. Cook from Capricornia CAE was studying in N.Z. and has since joined ASL. A full report has been published in the Newsletter.

(iv) AJMFR Referee Policy. Prof. Williams reported that some action had been taken and a report of this has been printed in the Newsletter.

(b) Current Business:

(i) Library. K. Shearer reported that the library was now established at Narrandera.

(ii) Jolly Award Account. It was decided to establish a fixed deposit account for the Jolly Award and to place sufficient money in the account for it to pay its own way. G. Grigg suggested a constitutional requirement for the deployment of money upon the abandonment of the fund.

(iii) Proposed Association of Scientific Societies. A letter from the joint secretaries section 11, ANZAAS was read out and it was resolved that W. Williams should attend a meeting of interested persons in Melbourne, and should report back to the Committee.

(iv) Consulting Service. President asked that ideas on this be sent to the Committee. There was considerable discussion on this matter later under Any Other Business. Generally it was felt that the Executive Committee needed to look into the matter carefully, and that it would be difficult for the Society to act as a body in this area.

(v) Any Other Business

(a) AGM: A number of people thought that there was insufficient time for the AGM and there developed a discussion about the relative importance of the AGM, paper sessions, excursions and informal contact between members at ASL Congresses. The incoming committee was asked to consider the AGM's comments when planning for the next Congress.

(b) B. McMahon drew attention to a Symposium on Aquatic Research in southern Queensland to be held during September.

(c) G. Arnott suggested that since people were interested in past conferences, a permanent slide display of conference activities be established.

(d) W. Jolly drew attention to plans to develop a large water storage for Brisbane and to the fact that the limnology of this project needs urgent consideration. He was asked to write to the incoming president offering suggestions for action.

(e) L. Llewellyn asked if May would be a suitable time for the next Congress. The meeting agreed that it was.

(f) D. Buckmaster congratulated D. Pollard and the outgoing Committee for their achievements during the past year.

Meeting closed 6.10 p.m.

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FOURTH EXECUTIVE COMMITTEE MEETING

May 20, Bennelong Motel, Lismore

1. Apologies were received from K. Walker, T. Hillman, L. MacMillan, D. Cannon, F. Reynolds, N. Ruello.

2. Correspondence.

   Secretary-Treasurer tabled recent correspondence and was instructed to send a membership list to Gustav Fisher Verlag in response to their request. A set of Bulletins would be sent to the Director of the Institute of Scientific Information, USSR Academy of Sciences. A letter from the coordinator of the Australian Picture Survey Postcard Project was left in abeyance since no knowledge of its background was available. A letter from the Pacific Science Association seeking payment for the Bulletin was considered; it was felt that there was little to be gained by the Society in retaining membership. Other correspondence was dealt with under consideration of the AGM agenda.

3. The remainder of the meeting was devoted to consideration of the AGM business. The following items were discussed in some detail.

   (a) Contact with schools. Correspondence from R. Grandison was discussed and it was felt that J. Clark who would be giving a paper during the Congress might help to establish an Educational Subcommittee which would look into this matter more closely.

(b) Project Aqua. Dr. Pollard outlined progress made with respect to the Society's submission to the National Heritage Commission. It was felt that I. Campbell should be asked to continue with this matter.

(c) Jolly Award. (i) It was resolved to recommend to the AGM that a sum be transferred from the General Account to the Jolly Award Account and used to establish a fixed deposit account for which the interest would pay for the Award book.

(ii) There was some discussion about a change of format for the Award itself. It was felt generally that some form of award to students could be made and that the present system of awards be left for special purposes. This matter was deferred for further discussion by the new Committee.

(d) Proposed Association of Scientific Societies. A letter from Dr. F.H. Drummond was read. It was felt that ASL could gain little from membership of the Association, but that it should send an observer to the discussion meeting proposed for August.

(e) Back issues of publications. Secretary-Treasurer referred to the large number of back issues of Newsletters, Bulletins, etc. It was suggested that these be made available for sale at each future AGM. Complete sets could be offered to members at a much reduced price.

The meeting closed at 11.45 p.m.

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FIRST EXECUTIVE COMMITTEE MEETING

May 22, Bennelong Motel, Lismore

Apologies were received from D. Cheng, J. Barclay, K. McKenzie, A. Fletcher, R. Williams.

Present: D. Buckmaster, D. Pollard, L. Llewellyn, R. Buckney (Acting Secretary), A. Arthington, I. Campbell, H. Yezdani, K. Shearer.

Business consisted of the following matters referred to the Executive Committee by the AGM or the previous Executive.

1. Project Aqua. D. Pollard outlined the situation with regard to the ASL submission to the National Heritage Commission. I. Campbell to continue preparation of a Society list for Project Aqua, and to complete the compilation of sites for the National Heritage Commission. A list is to be published in the Newsletter.

2. Newsletter. It was resolved that the Editor should have responsibility for warning contributors that publication in the Newsletter may prejudice publication elsewhere. Prof. Williams will be asked to supply a draft policy statement to the President for Committee scrutiny.

3. Consulting. There was considerable debate on this matter. It was thought that further discussion should be based on papers circulated among the Committee and prepared by those interested. Drs. Yezdani and Pollard agreed to prepare papers. These should also be published in the Newsletter for comment by members.

4. Education Sub-committee. Discussion on this topic revolved around the sorts of material ASL could publish. A series of slide collections for schools was thought appropriate. Secretary-Treasurer was instructed to write to J. Clark seeking a report on discussions with other members of the sub-committee; this report to be published in the Newsletter; members views would be solicited.

5. Constitution. D. Pollard volunteered to draft changes to the constitution for the next AGM. The changes would involve changes of wording and construction rather than content.

6. Cooloola Area Conservation Committee. Secretary-Treasurer was instructed to reply to the request for assistance stating the ASL policy on conservation issues as outlined in Newsletter 13(2), p. 16. The Committee invites a submission within that framework.

7. Jolly Award.

   (a) Discussion of a change of format for the Award was deferred till another time.

   (b) It was resolved that the Award Account be increased to $300 and deposited in a fixed deposit yielding 9% per annum.

   (c) W.D. Williams would be approached to join the Jolly Award Selection Committee. One of the present members should retire according to past practice.

8. Editorial Committee. It was resolved that this Committee remain unchanged for the time being.

9. Venue for XVII Congress. Considerable discussion on criteria for selection of a venue took place. Dr. Yezdani presented a strong case for Q.I.T. as a conference venue and it was resolved that the Committee recommend Q.I.T. as a feasible venue for the 1979 Congress.

   L. Llewellyn was asked to begin organizing the next Congress at Menindee.

10. A.G.M. Some discussion on the AGM took place. It was decided that people should be encouraged to provide printed material on major issues for discussion some time before the meeting. A note in the pre-conference Newsletter would be adequate, and arrangements would be made to ensure that this happened.

11. Next meeting to be held in Melbourne.

Meeting closed at 9 p.m.

LETTERS

FROM Drs. J.L. Hickman and A.M.M. Richardson, Department of Zoology, University of Tasmania: 22.4.77

The response to our letter of 29th June expressing concern about the lack of promotion of systematics in Australia has been disappointing.

As only four letters have been received we do not propose to pursue the matter further at this stage.

If you consider some comment in your publication regarding the poor response is called for we have no objection.

Thank you for allowing us space in your publication.

[No comment. Ed.]

FROM Ass. Prof. V.G. Phipps and Dr. G.G. Grigg, Department of Geology and Geophysics and School of Biological Sciences, University of Sydney: 6.6.77

For the past 3 years the School of Physics of the University of Sydney has been operating a 70' research ship in Northern Territory waters. It has recently come to our notice that increasing costs are forcing curtailment of its programme and the vessel's future is now in doubt.

For the past 10 years Marine Scientists in Australia have been deploring the lack of research ships for work in Australian waters. If the School of Physics' vessel passes out of the research/teaching area and into general charter, or is sold, this will augur poorly for any ship-proposals of universities and other institutions.

Rather than have the vessel passed out of the research/teaching field we would like to initiate a scheme whereby the vessel could be available to Universities, CAE's and museum scientists within Australia, at rates well within reach of individuals, through departmental funds or ARGC allowances. This scheme would require Government funding for the major recurrent expenditure, and the formation of a consortium of users.

The need for a research ship, voiced by so many scientists gives us confidence that a very strong case can be made for Government support. The object of this letter is to seek information and to invite potential users to indicate their interest in becoming part of a consortium to share use of the vessel.

We envisage that the planning and coordination of the vessel's time would be achieved by a committee made up of principal users from the various institutions while the general administration would be by the Marine Studies Centre in the University of Sydney.

Planning of cruises would be necessary 10-12 months in advance to allow for ARGC applications to be made for projects and so that teaching programmes can be planned. It is therefore anticipated that 1979 would be the first year of operation of this proposal.

It is at present envisaged that the ship will be in north Australian waters during winter months and in southeastern waters during the summer. We expect that through coordination and planning of projects, effective use could be made of the ship during passage to and from the north, such passage time being determined by requirements en route.

It is our intention to visit the main centres in eastern Australia in July/August to discuss the use of this vessel with those interested. We hope that, in the meantime, you will discuss this proposal within your particular department or university.

Enclosed is a brief questionnaire* which we have purposely kept in broad terms at this stage, and a list of specifications of capabilities of the vessel. We look forward very much to hearing your views.

SHIP SPECIFICATIONS AND CAPABILITIES

The ship was originally designed for work in Northern Australian rivers as a floating base for a research programme on crocodiles. To broaden her capabilities winches for geological and biological data collection in depths to 4000m were added plus a smaller winch for shallow work in shelf areas.

Experience has dictated that the ship's operations should be limited to within 200 miles of the coast as by nature of her design she is very uncomfortable in heavy seas. She is ideal in many ways for estuarine and river work, work in reef areas and on the continental shelf.

Length - 69 ft (21 m)
Beam - 22 ft (7 m)
Draft - 6.6 ft (2 m)
Twin engine - twin propeller
Cruising speed 8.5 - 9 knots, range 1000 miles
Electrical power - 415V, 3 phase; 240V, single phase
Permanent crew - 3: Captain, Engineer, Deckhand
Accommodation - Total 6 twin berth cabins
Scientific crew - 8 for extended periods
Large mess deck suitable for student discussions
Laboratory aft
Fully air-conditioned

*Not reproduced here. Available on application to Ass. Prof. Phipps.

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LIMNOLOGICAL LANDMARKS - THE FIRST FIFTEEN YEARS

BY D.A. POLLARD

The Inaugural General Meeting of the "Australian Society of Limnology" (as it was originally known) was held at Monash University on Saturday 26th May 1962 - so in less than a week's time the Society will be exactly 15 years old.

As I've always regarded 15 as the age of consent, I consider that the Society has now come of age and should be able to bear some historical, and maybe a little sociological, scrutiny.

When I first thought of presenting something along this not too serious line as a Presidential Address, I wrote to a number of the old hands requesting the loan of a few slides illustrating some of our vintage limnologists at work and play in earlier days. Several of those I wrote to managed to dig up the odd slide or two, and most of those who replied, even if they had no suitable offerings, thought it wasn't such a bad idea. The single exception, however, was one of our most distinguished members, who strongly disagreed - so I'll read you his reply:

"Dear David,

Thanks for your note requesting funny slides. I shall send you some shortly, you may count on it, but just a quick comment on the idea. I am not at all in favour of it! It does seem to me that as President of the Society we can expect something more substantial than the social history of previous A.S.L. conferences. No doubt the talk as you plan it will be entertaining, edifying and become part of the atmosphere, so to speak, but I think that we ought not to let the society slide too far down, or up, the social scale and because of that I would have thought a slightly more serious contribution would have been in order. This is, of course, my opinion only and it may well be that others feel that the sort of talk you intend is more appropriate. I am sure I will enjoy your talk but frankly I would have preferred one which, for example (knowing your area), outlined the current status of inland fisheries research in Australia, reviewed what's going on and detailed some of the major gaps in research. Christ Almightly, we have very little input in this area at all at the moment and the only person of any merit, that is yourself [note the flattery!], proposes to talk about the social history of the A.S.L.! Enough, Pollard, I think you ought to talk about fish. Etc.

Best wishes.

Yours sincerely,

(Signed, A Distinguished Australian Limnologist who shall remain anonymous)

As I've been talking continuously about fish at A.S.L. Congresses for nearly 15 years, for a while these comments had me a little perturbed and I wondered what this man may have to hide. I found out, however, when I received some evidence of his notorious past in the form of a slide taken in the field by his most eminent colleague and collaborator. [Here followed a slide showing this Distinguished Australian Limnologist, circa 1963, attempting to take a skinny-dip in Lake Dunn, Central Queensland, which nobody told him had an average depth of only 3 inches.]

If the gentleman in question would care to see me after the meeting I will tell him everything he always wanted to know about fishes.

This talk is meant to be at least half-serious though, so I'll return to the History of the A.S.L.

Those of you who were at last year's Congress, or who read Ian Bayly's Inaugural Hilary Jolly Memorial Lecture in the Winter 1976 Newsletter, will be aware of how Hilary originally sowed the seed of an Australian Freshwater Biological Association in the minds of John Lake and Jim Wharton in 1961. These three convened a meeting of interested people in Canberra in October 1961, and the Inaugural General Meeting was arranged and held at Monash in May 1962. The Society's first Constitution was ratified at this Monash meeting, and the Objectives of the Society were defined as "To establish effective liaison between all persons interested in any aspect of fresh or brackish water research in Australia, and to promote the study of and encourage these interests in State and Commonwealth Research Institutes and Departments, and educational Institutions".

However, the wording of these Objectives has since become distorted in subsequent updated versions of this Constitution, and today one of the main objectives of the Society is clearly stated as to promote the study of persons interested in any aspect of fresh or brackish water research in Australia. (See the amended Constitution in Newsletter Volume 14, Number 1, 1976.) A detailed sociological study of Society members is thus clearly called for in our Constitution but I'll leave this for another time and return once more to the history of the Society.

One interesting point recorded in the Minutes of the Inaugural Meeting was a resolution of the 1961 Canberra meeting stating "That an association of persons interested in freshwater biology should be formed and that consideration might later be given to the incorporation of marine interest". At this early time we could thus have easily ended up with an Australian Hydrobiological or Aquatic Sciences Society, incorporating what was later to become the Australian Marine Sciences Association, but apparently one of our prominent founding members, Alan Weatherley, didn't see eye to eye on many matter with Geoffrey Kesteven, the Deputy Chief of C.S.I.R.O. Fisheries, so Geoffrey went ahead and formed our sister society, AMSA, in May 1963. It was eleven years before the two societies finally buried the hatchet and held a joint meeting, with the Australian Society for Fish Biology as mediator, at Tewantin in Queensland in 1974.

Returning to the Inaugural ASL meeting at Monash in 1962, about 30 people attended and the subs. were set at two quid for adults and five bob for children.

Our first President was Aubrey Nicholls, John Lake was (most appropriately) elected Vice President, Bill Williams Secretary-Treasurer and Alan Weatherley Newsletter Editor. The Committee was made up of Hilary Jolly, Jim Wharton, Ian Bayly and Edgar Riek. As has been traditional ever since, there were no other nominations and all were elected unanimously.

Four papers were presented at the Monash Congress - two on fish and fisheries, one on insects and one on copepods, setting the balance according to the relative importance of these major components of our aquatic fauna - a formula which has been followed fairly assiduously ever since. (For further details consult John Lake's letter on p. 3 of Newsletter Volume 7, Number 3, 1969.)

The Monash Meeting was followed by a visit to Snobs Creek Freshwater Fisheries Research Station and Hatchery, where the members were (and I quote) "entertained by Mr. Jim Wharton and his staff". Part of this entertainment was apparently quite lascivious as it was recorded that the members enjoyed a demonstration (and I quote again) of the "stripping of female trout".

Unfortunately I missed this Inaugural Meeting, and Jim Wharton's Snobs Creek Fish Follies, as I was an impoverished Zoology Honours student at Sydney University at the time, and though I had heard of the Monash meeting and the proposed formation of the Society I didn't have the fare to Melbourne.

I did visit Monash the following year, though, and ended up staying for five years and acquiring the dubious distinction of graduating as Monash's first Ph.D. Limnologist.

Having thus just missed out on being one of the founding fathers of Australian Limnology, I did manage to get to the second Congress in Narrandera in 1963, and presented my first paper at the third Congress in Canberra in 1964. Since that time I've been to every Congress except for four which I missed through being overseas.

Although I've often been involved in the continuing everday affairs of the Society as Secretary-Treasurer, Bulletin Editor, and on a number of occasions as an Executive Committee Member, to me the real ethos of the A.S.L. is best reflected in its Annual Congresses. Each one has been memorable in its own distinctive way, and I could talk to you for an hour on what went on at each and any one of them.

However, I'll spare you the remaining 14 hours of this talk, as I notice that I've so far hardly managed to cover the history of the Society and its Congresses up to the end of 1962. I would, however, one day like to write a slightly more serious and comprehensive history of the Society, which I might inflict on you in serialised form in the Newsletter if I ever find the time. Meanwhile I'll show you a few slides taken at some of the earlier Congresses which were kindly lent to me by Ian Bayly, John Glover, Derek annon, John Lake, Leighton Llewellyn, Bill Williams, Jim Wharton, and others.

Before doing this, however, I'd like to thank you for electing me your President for 1976-77 - especially as these days I'm not even really a practising limnologist, and could thus be accused of holding this distinguished office under false pretences!

(Copies of the following slides have been deposited in the Society's archives, which are held by our Librarian, Karl Shearer, at the Inland Fisheries Research Station, Narrandera, N.S.W. If any other Society members have other slides of this nature relevant to the history of the Society and its Congresses could they please send them to Karl for duplication.)

PAST A.S.L. CONGRESSES AND EXECUTIVES

Congress Venue	Date	President	Vice-Pres.	Sec./Treas.
1. Melbourne (Vic.)	1962	Nicholls	Lake	Williams
2. Narrandera (N.S.W.)	1963	Lake	Weatherley	Williams
3. Canberra (A.C.T.)	1964	Lake	Jolly	Francois
4. Brisbane (Qld.)	1965	Weatherley	Bayly	Francois
5. Miena (Tas.)	1966	Strahan	Lynch	Francois
6. Warragamba (N.S.W.)	1967	Wharton	Lynch	McKenzie
7. Renmark (S.A.)	1968	Jolly	Francois	Lake
8. Jindabyne (N.S.W.)	1969	Lynch	Hiscock	Wharton
9. Colac (Vic.)	1970	Hiscock	Bayly	Wharton
10. Hobart (Tas.)	1971	Francois	Morrissy	Pollard
11. Narrandera (N.S.W.)	1972	Williams	McMichael	Wharton
12. Jamieson (Vic.)	1973	McMichael	Midgley	Buckmaster
13. Tewantin (Qld.)	1974	Powling	Tyler	Buckmaster
14. Canberra (A.C.T.)	1975	Walker	Buckmaster	Buckney
15. Tanunda (S.A.)	1976	Pollard	Cannon	Buckney

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SCIENTIFIC PAPERS DELIVERED AT THE XVI CONGRESS

The scientific programme of the Congress is indicated below. It is followed by those abstracts of papers subsequently forwarded to the Editor.

SCIENTIFIC PROGRAMME

ANTARCTIC LIMNOLOGY SESSION

H. BURTON - "Stability of an Antarctic Saline Lake"

R. BARKER - "Chemistry of an Antarctic Saline Lake"

R. WILLIAMS - "Algal Ecology of an Antarctic Saline Lake"

P. CAMPBELL - "Primary Productivity of an Antarctic Saline Lake"

BIOLOGICAL LIMNOLOGY SESSION

M. FINLAYSON - "Aspects of the Hydrobiology of the Leichhardt River - Lake Moondara Water Supply System, Mt. Isa"

D. BUCKMASTER - "Freshwater Fisheries in Victoria - Recent Developments"

R. TILZEY - "An Examination of Catch Data from the Lake Eucumbene Trout Fishery, 1959-1977"

G. GRIGG - "A Preliminary Look at Salt and Water Balance in the Estuarine Crocodile"

K. McKENZIE - "Ostracoda of Southern Australian Salt Lakes: A Preliminary Report"

P. LAKE - "Of Winecellars and Psammaspids"

GENERAL LIMNOLOGY SESSION

J. CLARK - "The Potential for Limnological Studies as a Unifying Theme in Secondary Science Education"

E. SCRIBNER - "Vertical Quantum Extinction Coefficients in N.S.W. Lentic Waters"

K. McKENZIE - "Preliminary Report on Aquifers of the Murrumbidgee Floodplain"

J. LAKE - "Hands on Research" - an unedited uncensored videotape featuring the Dawson River, SCLEROPAGES LEICHARDTI and Bwana Midgley.

ENVIRONMENTAL LIMNOLOGY SESSION

C. MILLIGAN - "The Lake Burrumbeet Investigation - Findings of the Study and Methods of Research"

B. TIMMS - "The Derogation of the Delectable Dune Lakes of Northeastern N.S.W."

K. BISHOP - "Welcome Reef Dam Environmental Impact Survey, Shoalhaven River System"

J. BELL - "The Impact of River Flow Stoppages below Tallowa Dam on the Fish Fauna of the Shoalhaven River System"

J. WHARTON - "The Threat of Introduced Aquarium Fishes to Northern Waters of Australia"

R. PEARSON - "The Biotas of North Queensland Rivers and the Hazards confronting them"

N. WILLIAMS - "Mining Pollution and the Diet of the Gudgeon *Mogurnda mogurnda*"

THE STABILITY OF AN ANTARCTIC SALINE LAKE

by H.R. BURTON

(Biology Section, Antarctic Division,
568 St. Kilda Road, Melbourne, 3004.)

Deep Lake (260 g/l) is generally monomictic, mixing in winter at a temperature of about -17°C. Deep Lake's total stability (see Walker) in most years is completely thermal but nevertheless high, ranging from 4073 g cm/cm^2 in 1975 to 6061 g cm/cm^2 in 1976. This situation arises both because solar radiation at the latitude of Deep Lake (68° 24' south) is markedly seasonal, with monthly global radiation reaching 19,000 calories/cm^2 in December but only 6 calories/cm^2 in June; and because the high salinity prevents surface ice formation. This last characteristic allows the sun and wind unimpeded access to the lake water surface at all times of the year.

Despite the strong mid-summer solar radiation, epilimnial temperatures do not rise above about +10°C (mean January air temperature is +0.5°C); however, evaporative losses are considerable and they can reduce the lake water level by several centimetres. During the 1974/75 summer, the T.D.S. of the epilimnion increased by 2 g/l and the density also increased as a result. The lower stability figure of 4073 g cm/cm^2 is a consequence. But in 1976, reduced solar radiation and less evaporation produced much greater stability. Paradoxically therefore, summers which have high solar radiation inputs may produce less thermal stability in Deep Lake than those summers with less solar radiation.

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THE CHEMISTRY OF AN ANTARCTIC SALINE LAKE

by R.J. BARKER

(Biology Section, Antarctic Division,
568 St. Kilda Road, Melbourne, 3004.)

Deep Lake was originally part of the sea but became isolated after isostatic uplift of the surrounding hills. The combination of low annual precipitation, small catchment area and rapid evaporation has resulted in concentration of the water until the surface level of the lake is now 56 metres below sea level and the total salt concentration is 260 g/litre.

Water samples were collected from August 1973 to January 1976 for chemical analysis. Major ion concentrations (Table 1) were generally uniform throughout the water column although slight changes occurred near the surface in response to evaporation, precipitation and melt-water inflow. During 1974 and early 1975 a slightly more concentrated layer of water (Cl^- = 166.8 to 167.9 g/litre) existed below a depth of 30 metres, while the water above varied from 164.5 to 165.2 g/litre of Cl^-.

A concentration factor of 10.5 was calculated from the K+ values in sea-water and Deep Lake. This was then used to calculate a theoretical value for the other major ions in Deep Lake. From Table 1 it appears that large quantities of Na^+, SO_4^{2-} and Cl^- have been lost from solution during concentration of the lake water. Large deposits of mirabilite (Na_2SO_4 $10H_2O$) around the lake and in sediment cores account for the loss of Na^+ and SO_4^{2-} ions and Cl^- ions were most probably deposited as NaCl.

Dissolved oxygen concentrations (1.99 to 2.61 ml/litre) were close to assumed saturation values throughout the lake and generally varied only with water temperature. However, the water below 30 metres in 1973 and 1974 had a slightly lower oxygen concentration than expected and this was probably associated with the higher salinity and small temperature increase found near the bottom.

Total-P (271.4 µg/l) and Reactive PO_4-P (57.7 µg/l), NO_3-N (71.9 µg/l), NO_2-N (3.03 µg/l) and SiO_2-Si (2,950 µg/l) concentrations were within the ranges given for sea-water and showed only slight variations with time and depth.

TABLE 1. Major ion concentrations (g/litre)

	Sea-water	10.5 x sea-water	Deep Lake
Cl^-	19.87	208.6	165.0
SO_4^{2-}	2.78	29.2	2.7
Ca^{2+}	0.42	4.4	2.4
Mg^{2+}	1.33	14.0	11.8
Na^+	11.05	116.0	65.8
K^+	0.41	4.3	4.3

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PHYTOPLANKTON IN AN ANTARCTIC SALINE LAKE

by R. WILLIAMS

(Biology Section, Antarctic Division,
568 St. Kilda Road, Melbourne, 3004.)

Two major types of aglae are present; the most common is a coccoid chlorophycean 3-5 µm diameter which is found throughout the year and has a maximum population of 8.5×10^4 cells/litre. The other type is a biflagellate chlorophycean 10-12 µm long and found only in summer with a maximum population of 8.4×10^3 cells/litre.

Counts of the biflagellate chlorophycean are too low and infrequent to justify any further interpretation. Coccoid chlorophycean numbers change little, but they are generally higher in summer and autumn than during the rest of the year. Variation of cell numbers with depth is more marked. Throughout the year there is greater variability in cell numbers and generally higher absolute numbers above 15 m than below it. This depth coincides with the maximum depth of the epilimnion where temperatures higher than -5^oC occur. This temperature must be close to the lower limit for photosynthesis of aquatic algae.

It is suggested that metabolically active phytoplankters only occur in the warm epilimnion in summer, which explains the generally higher numbers in this region. Sinking of these cells into the hypolimnion accounts for lower and less variable cell numbers there. A sinking rate of 1 m per day has been measured for these algae, which supports this theory. An alternative hypothesis involves cells

being disturbed from the bottom sediments in shallow water near shore areas by the epilimnetic circulation and their subsequent sinking to the hypolimnion. Whatever mechanism is operating, the algae must be growing at an extremely slow rate, as indicated by the low standing crop and the small changes that occur in it.

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PRIMARY PRODUCTIVITY OF AN ANTARCTIC SALINE LAKE

by P. CAMPBELL

(Biology Section, Antarctic Division,
568 St. Kilda Road, Melbourne, 3004.)

Few organisms live in Deep Lake, in the Vestfold Hills, Antarctica. Their primary productivity is of interest since they are subjected to extremes of salinity, temperature, and light. Results from *in situ* ^{14}C incubations in both the limentic and benthic zones set the total primary productivity at less than 10 grams carbon metre^{-2} year^{-1}, which places Deep Lake among the least productive lakes in the world. The singular and collective importance of hypersalinity, temperature, light, nutrient deficiency, and geographic isolation in the limitation of production is discussed.

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ASPECTS OF THE HYDROBIOLOGY OF THE LAKE MOONDARRA-LEICHHARDT RIVER WATER SUPPLY SYSTEM, MOUNT ISA

By C.M. FINDLAYSON

(Botany Department, James Cook University,
Townsville)

A preliminary report is given of a one-year programme of sampling and analysis of the physico-chemical and biological characteristics of Lake Moondarra - an artificial lake on the Leichhardt River approximately 19 km downstream of Mount Isa. Nutrient levels in the main body of the

lake are characteristic of an oligotrophic system despite high values in effluent inflows. Other aspects of the water chemistry are described and compared to other Australian lakes. Temperature and dissolved oxygen stratification is described. The effect on water quality of the extensive mats of *Salvinia molesta* and *Hydrilla verticillata* in relation to the absorption of heavy metals is described.

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FRESHWATER FISHERIES IN VICTORIA - RECENT DEVELOPMENTS

By D.E. BUCKMASTER

(Fisheries and Wildlife Division,
Ministry for Conservation)

Several years ago, senior Sectional Staff convened a meeting to discuss priorities and objectives in our research and management activity, with a view to development of a firm plan for future action. As a result of that meeting, an overall plan was produced and submitted to the Director, Fisheries and Wildlife, who subsequently endorsed our proposals.

What follows is a brief account of our current activities, indicated by the persons responsible for them.

SNOBS CREEK STATION

Mr. Len Ashburner is involved with continuing investigations into fish diseases and parasites, primarily in relation to fish culture operations. He is also heavily involved in discussions relating to the introduction of exotic fish species into Australia.

Len is currently developing a number of tissue culture lines, based on trout and Murray cod. This work is being done in conjunction with the Zoology School at the University of Melbourne. The aim of the work is to provide a facility for investigation of the virus status of local fish species.

Dr. Phil Cadwallader is responsible for an intensive study of the Seven Creeks System upstream of Euroa. This stream carries a unique population of Macquarie perch and trout cod, and is in fact the only Victorian location available for study of the two species. The Division plans to develop an experimental culture facility on this stream in the near future, and Phil will be deeply involved in the project.

ARTHUR RYLAH INSTITUTE

Dr. John Beumer is responsible for the Division's research into the biology of Victoria's two species of freshwater eels. A study of the biology of adult eels of both species is being undertaken at McLeod's Morass, on the Mitchell River in Gippsland, and involves tag and recapture studies, stomach analyses, and other routine observations.

John will be undertaking detailed studies of glass-eel and elver movements in selected rivers (e.g. Cann River and Hopkins River) from July to December this year, and also plans to implement a program for sampling commercial catches. He is also providing advice to an experimental eel farm at Perry's Bridge, Gippsland.

Dr. Peter Jackson has already completed eighteen months' study of river blackfish in the McKenzie River, immediately below Lake Wartook in the Grampians. Apart from routine observations of stomach contents, ageing of fish from scales, and home range studies, Peter has already determined a great deal about spawning behaviour of blackfish in the McKenzie River.

It appears that in the McKenzie River at least, this species spawns in hollow logs, and disperses adhesive eggs in a single layer. Eggs take about 2 weeks to hatch at temperatures between 10 and 20°C.

The newly hatched fry appear to be "locked" in the ruptured egg shell by their large yolk sac, for about 3 weeks after hatching.

Peter intends to continue his studies, particularly in relation to post-hatching behaviour of young fish, over the next spawning season. The results of his work will have great relevance to discussions currently in progress, in relation to the effects of "river improvement" on blackfish.

Mr. Bruce McCarraher has documented the distribution of Australian bass and Estuary perch in Victorian coastal streams. It now appears that perch occur in all such streams, but bass are restricted to East Gippsland. Spawning of perch was recorded from September to November, but the exact location of spawning sites is still unknown. Similarly, the importance of salinity and stream flow has not been determined.

Bruce intends to use sonic tags this spawning season, in an attempt to define more precisely the location and time of spawning.

OTHER PROJECTS

The Pilot Project at Lake Charlegrark is now operational, and work on induced spawning and intensive culture of Murray cod will commence later this year. The results of our investigations will be applied to further development of the Division's plans for a major inland Warm Water Fisheries Station.

A similar Project on the Seven Creeks, referred to earlier, will probably be commenced in 1978. This project will concentrate on spawning and intensive culture of Macquarie perch and trout cod.

The Impact of European Carp on Fish and Waterfowl in Victoria will be the subject of a major new research program, for which Government approval has recently been announced. The program will get underway as

soon as appropriate additional staff have been appointed, and will take about 3 years to complete.

The Section is also involved in Environmental Assessment Studies associated with major programs directed by the Victorian Ministry for Conservation, particularly the Gippsland Regional Environmental Study. Similar work on the Mitta Mitta River (Dartmouth Dam Project) has recently been completed.

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AN EXAMINATION OF THE ANGLING CATCH FROM LAKE EUCUMBENE, N.S.W.

By R. Tilzey

(N.S.W. State Fisheries)

Lake Eucumbene is the largest lentic trout fishery on the Australian mainland. Two trout species, brown and rainbow, occur in the lake. Analysis of catch data for the 1959/60 to 1976/77 seasons showed a trend towards increasing brown trout dominance (over rainbow) with their representation on the angling catch rising from 29% in 1959/60 to 62% in 1976/77. The mean seasonal weights of browns and rainbows in the angling catch declined over this period from 1984 gms to 748 gms and from 1361 to 624 gms, respectively. Examination of length frequency plots for each season throughout 1965/77 showed the size-composition of the brown trout catch to remain constant, apart from an overall shift towards smaller fish, and a relatively stable pattern of recruitment into the rod fishery. The size composition of the rainbow trout catch, and their recruitment, fluctuated considerably from season to season. Age-analysis showed the great majority of brown and rainbow recruits to be 2+ years old. Brown trout catches were largely comprised of 2, 3, 4 and 5 years old fish and rainbow trout of 2 and 3 years old fish.

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SALT AND WATER BALANCE IN THE SALT WATER CROCODILE, CROCODYLUS POROSUS

By G.G. GRIGG

(School of Biological Sciences,
University of Sydney)

The Liverpool and Tompkinson Rivers, which enter the sea in a common estuary at Maningrida, N.T., present an extensive salinity gradient in the dry season. Sampling as part of a continuing study of the population ecology of *Crocodylus porosus* in these rivers provided an opportunity to describe ionic and osmotic homeostasis in a natural population of euryhaline reptiles. Some 24 separate variables were analysed in plasma samples from 150 individuals. The same variables were analysed in urine samples from 50 of these animals.

The results from plasma indicated excellent ionic and osmotic homeostasis throughout the salinity gradient. Mean plasma osmotic pressure was 304 mosm and showed no trend with salinity. Ionic constituents of the plasma, Na^+, K^+, Cl^-, HCO_3^-, Mg^{2+}, Ca^{2+} and PO_4^{4-}, were all independent of external salinity.

This constancy in the blood plasma is in sharp contrast to the results of urine analysis. In salt water, production of insoluble nitrogenous wastes predominates as ammonia excretion typical of freshwater is replaced by production of urea, creatinin, uric acid and its salts. At higher salinities, increased concentration of K^+, Mg^{2+} and Ca^{2+} were seen whereas HCO_3^- decreased in the urine. The urine seems not, however, to be a major route for excretion of sodium or chloride and the presence of an as yet unidentified salt gland is suspected. Large amounts of HCO_3^- (as ammonium bicarbonate) in the urine from crocodiles in freshwater correlates with a low respiratory quotient (mean 0.49).

The study is seen as preliminary and descriptive only and it is hoped that more detailed experimental work will follow.

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OSTRACODA FROM SOUTHERN AUSTRALIAN SALT LAKES

By K.G. McKENZIE

(School of Applied Science, Riverina College of Advanced Education, Wagga Wagga, N.S.W., 2650)

During December 1971 and March 1972 collections were made in South Australia and Western Australia by W.D. Williams from numerous salt lakes. The samples containing ostracods, 27 in number, were forwarded to the author in December 1973. One sample was destroyed in transit leaving 26 samples - 14 from South Australia and 12 from Western Australia. Thirty ostracode taxa have been identified from this material, including several which are represented only by indeterminable juveniles or fragments. Table 1 gives the data.

Of the 30 taxa, 26 belong in the superfamily Cypridacea and 4 in the superfamily Cytheracea. This reflects the general preponderance of cypridaceans over cytheraceans in shallow continental environments even when salinities approach or exceed marine salinities. In this context, pH of the South Australian samples ranged from 7.0 - 8.3 (mean 7.8) and of the Western Australian samples from 7.3 - 9.5 (mean 8.5).

Two of the cytheracean genera, *Cyprideis* and *Limnocythere*, are common in shallow continental environments. *Cyprideis* is polyhaline but the record of *Limnocythere* from a salt lake with a pH of 8.6 is atypical for the genus which normally occurs in oligohaline environments. Both the remaining cytheracean genera usually have marine affinities only, so the present records are particularly interesting on this account although it is noted that both localities are close to the sea.

The cypridacean taxa comprise at least 6 genera of which one is new. Further, the taxon recorded as cypridid sp. may represent a second new generic category although another researcher considers it to be a *Diacypris*. The pH ranges of these genera in the samples are as follows: *Australocypris* 7.0 - 9.5; *Mytilocypris* 8.2 - 9.4; *Platycypris* 7.9 - 8.7; *Diacypris* 7.0 - 9.4; new genus 7.0 - 8.8; Cypridid sp. 8.2 - 8.6; *Cyprinotus* 8.8 - 9.4.

In most cases, these pH ranges are consistent with known tolerances of the genera concerned. But it is unusual to record *Cyprinotus* at such high salinities; elsewhere the genus is typically oligohaline-brackish (Okubo 1974).

The genera *Australocypris* and *Mytilocypris* have special interest because they are relatively large ostracodes, usually greater than 3 mm in length (McKenzie 1971).

Table 1 shows that the numbers of ostracode taxa per sample are low, ranging from 1 to 6. This is typical of continental environments. (In shallow marine samples, on the other hand, 30 or more ostracode species can be expected.) Further, 16 of the taxa are represented by single records only and only 10 species have three or more records in the samples. These 10 species are: *Australocypris hypersalina* De Deckker; *Mytilocypris tasmanica* McKenzie; *Mytilocypris* nov. sp.; *Platycypris baueri* Herbst; *Diacypris dietzi* (Herbst); *D. fodiens*

(Herbst); *Diacypris* nov. sp. A; *Diacypris* nov. sp. B; *D. whitei* (Herbst); nov. gen. nov. sp. This group of (relatively) common species may be considered characteristic of southern Australian saline lake environments.

Biogeographically, the fauna is endemic at the species level, except that *Limnocythere mowbrayensis* Chapman occurs as a fossil in New Zealand (Hornibrook 1955). At the generic level, all the cytheraceans are cosmopolitan, although *Cytheroma* and, more particularly, *Microcytherura* are rarely recorded beyond the Mediterranean and Atlantic.

Most of the cypridacean genera are endemic; *Cyprinotus* being the one exception. This genus, which was originally described from Ceylon, ranges from Africa via Indo-Malaya to Japan and from the eastern U.S.S.R. to Australia. It is known as a fossil from Saudi Arabia and India (Sohn and Morris 1963, McKenzie 1972).

The remaining cypridacean genera are all referred to endemic tribes: *Australocypris* and *Mytilocypris* to Mytilocypridini; *Platycypris* to Platycypridini; *Diacypris*, the new genus and cypridid sp. to Diacypridini. Of these tribes, the Mytilocypridini and Platycypridini appear to be related to the Megalocypridini and Isocypridini in South Africa. The author has commented previously on the significance of these parallel distributions of related austral genera (McKenzie 1971). But the Diacypridini do not show obvious morphological similarities to other tribes. Previously classified with the cosmopolitan Eucypridini, they can be easily distinguished from eucypridines at least by their generally smaller size. By comparison with the relatively well known South African fauna, they appear to occupy the niches in Australia which accommodate Cypridopsinae in South Africa. Indeed, like Diacypridini, the South African cypridopsines not only are relatively small but also are represented by numerous species. Cypridopsines do occur in southern Australia but they are not as common as the almost ubiquitous Diacypridini, especially in saline environments.

It is generally concluded elsewhere that although the macro-invertebrate fauna of Australian salt lakes is quite different from that of salt lakes in other parts of the world, within the southern part of Australia at least it is homogeneous (Williams and McKenzie in preparation). This conclusion is supported by the data on cypridacean ostracodes as Table 1 indicates. Further, the sizes of the shallow saline environments sampled, whether they be small pools or large lakes appear to have little influence upon ostracode distributions at either the specific or generic levels.

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	South Australia														Western Australia												
Species Localities	2	3	15	17	19	21	28	30	33	36	38	39	40	41	5	7	8	10	12	13	14	27	28	29	30	37	Totals
Australocypris hypersalina	X	X	X								X	X		X	X	X	X	X	X								11
Australocypris robusta													X														1
Australocypris sp.										X																X	2
Australocypris (indet.)							X																				1
Mytilocypris tasmanica																X	X				X			X			4
Mytilocypris nov. sp.																			X	X					X		3
Mytilocypris sp.													X														1
Mytilocypris (indet.)																							X				1
Platycypris baueri		X			X						X	X		X			X	X	X								8
Platycypris indet.							X																				1
Diacypris dietzi	X	X	X	X			X				X	X	X														8
Diacypris fodiens		X			X					X																	3
Diacypris nov.sp.A																	X	X	X	X							4
Diacypris nov.sp.B							X				X	X															3
Diacypris whitei			X	X	X							X															4
Diacypris sp.1 (W.A.)																X				X							2
Diacypris sp.2 (S.A.)													X														1
Diacypris (indet.)			X																		X						1
Nov.gen.sp.A				X	X							X		X		X											1
Nov.gen.sp.B.																										X	1
Nov.gen.sp.											X																1
Nov.gen. (indet.)																				X				X			1
Cypridid sp.																					X						1
Cyprinotus edwardi																					X					X	1
Cyprinotus sp.																									X		1
Cypridid (indet.)																											1
Limnocythere mowbrayensis						X																					1
Cytheroma sudaustralis								X														X			X		2
Cyprideis westraliensis									X																		1
Microcytherura difficilis																											1
TOTALS	2	4	4	3	4	1	4	1	1	2	5	6	4	3	1	4	4	3	4	4	3	1	1	2	3	3	
Large lake		X						X	X	X	X	X	X	X	X		X	X	X	X	X	X	X	X	X	X	
Small lake	X		X	X	X	X	X									X											
pH	8.3	7.9	7.0	7.7	8.0	8.1	7.5	8.3	7.7	?	?	?	?	?	9.5	8.2	8.2	8.7	8.3	8.2	9.4	?	7.3	8.6	8.6	8.8	

OF A WINE CELLAR AND PSAMMASPIDS

By B. KNOTT and P.S. LAKE

(Department of Zoology, University of Western Australia, Nedlands, W.A.

&

Department of Zoology, Monash University, Clayton, Vic.)

A new family of anaspidacean syncarid crustaceans, the Psammaspididae was erected in 1974 by H.K. Schminke when he described *Psammaspides williamsi*. The single male holotype was collected from a creek bed near Hall's Creek, N.S.W. In mid-1974 and mid-1975, males and females of a new species of psammaspid were collected from an underground spring in a wine cellar at 6 Payton Place, Devonport. The new species strengthens the definition of the family Psammaspididae and clarifies the taxonomic status of the stygocarids. A new taxonomic scheme for the order Anaspidacea so that it consists of two suborders, the Anaspidinea and the Stygocaridinea, is proposed.

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THE POTENTIAL FOR LIMNOLOGY AS A UNIFYING THEME IN SECONDARY SCIENCE EDUCATION

By J. CLARK

(St. George's Crescent, Faulconbridge, N.S.W. 2776)

Traditionally, secondary science syllabuses have been relatively prescriptive in terms of content and implementation. This is a natural consequence of their often unstated, overambitious and perhaps naive fundamental aim - to provide a basic factual and conceptual background in the four traditional scientific disciplines; physics, chemistry, biology and geology. Physicists, chemists, biologists and geologists co-opted onto syllabus committees in the past have understandably been anxious to maintain parity, and perhaps to promote ascendancy of their own discipline over others. This tendency, in concert with the exponential growth rate of scientific knowledge, has led to breadth at the expense of depth in syllabus content.

In recent years however, teachers have actively sought more autonomy in devising and implementing science syllabuses. In N.S.W. at least, such pressure has brought about radical change, in the form

of an essentially vague, revised syllabus - a two-page statement of aims and content. Teachers are now free to develop their own sequence of studies in some depth, without the tyranny of an external exam to stifle creativity, skill development, and attitude formation. A synopsis of the syllabus appears below:

STATEMENT OF AIMS

1. Interests and attitudes: To develop a lively interest in understanding, to develop critical thinking, a desire for personal and community health, a belief in the value of conservation, and perseverance with a task.

2. Knowledge and understanding: To establish a store of facts, ideas and laws. To develop the ability to recognise a problem which may be solved by science; to understand the importance of patterns in solving problems; to develop an understanding of how science contributes to society.

3. Skills: Communicating, observing, manipulating.

STATEMENT OF CONTENT

1. The things around us - within and beyond our local experience
2. Natural changes
3. Man-made changes
4. Processes of living
5. Relations between living things and the earth
6. Communicating

The new syllabus is best interpreted in terms of themes which transcend both the traditional scientific disciplines, and the sub-headings in the statement of content. This permits the in-depth treatment of an internally cohesive theme over a long period of time, incorporating the substance and spirit of the stated aims. I have used a long-term limnological study as a unifying theme, with (I believe) considerable success.

There were three stages in the study sequence, corresponding to the second, third and fourth years of secondary schooling, viz.:

1. Descriptive phase
2. Analytical phase
3. Manipulative phase

1. The sequence began with an excursion to Bent's Basin, on the Nepean River, N.S.W. Sampling, examination and description were the principal activities. Aquatic invertebrates and macrophytes were collected and described in terms of structure, location and limits of distribution. Geological and hydrological features were also noted.

2. Building on stage 1, dichotomous keys were devised and tested in the field, chemical tests and quantitative measures of environmental parameters were undertaken. The object here was to investigate patterns and relationships to the point where hypotheses could be developed.

3. Hypothesis testing, experimental design, induction and deduction, statistical manipulation. Students were left to their own resources, with the teacher as consultant. A high degree of sophistication in the cognitive processes of outstanding students was very evident in this student-centered phase.

Students were highly motivated throughout the project, because of the intrinsic aesthetic appeal of the 'object of contemplation', and because all activities were unified, goal-oriented and practical. The major limitation experienced during the study sequence was a lack of teaching resources, in terms of:

1. Reference books and field guides. These certainly exist, but Australian publications are either too general, or too difficult for the junior secondary student.

2. Illustrative and audio-visual material. Non-existent, dated or irrelevant for the Australian student.

3. Kitsets, practical guides, instructional manuals were unobtainable so that teacher expertise became the major limiting factor in field and laboratory investigations.

It has been suggested that the Society consider an educational role (Newsletter Vol. 14, No. 2), a proposal I strongly endorse* in the interests of both limnology and secondary science education.

*Note to Editor

As a result of this paper I have been asked to coordinate an initial move to establish an educational function. The nature of such a function should reflect the aspirations and expertise of the collective membership. I would like to invite members who have suggestions, experience, access to resources or anything else to offer, to contact me directly at the address below:

26 St. George's Crescent,
Faulconbridge, N.S.W. 2776.

Submissions will be incorporated into a consensual statement to the executive committee, after which an educational sub-committee of interested members will be convened to determine policy and programs.

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VERTICAL QUANTUM EXTINCTION COEFFICIENTS, AND THEIR SIGNIFICANCE, IN NEW SOUTH WALES LAKES

By E.A. SCRIBNER

(N.S.W. State Fisheries)

The measurement of light attenuation in water by means of a photometer with quantum response, such as the Lambda Instrument Corporation's LI190S, is now generally considered to be the best single measurement of light available for photosynthesis.

This measurement has been made on a number of New South Wales lakes and the values of Vertical Quantum Extinction Coefficient so obtained are discussed, together with related measurements - beam transmission of filtered samples at 440 nm, chlorophyll concentration and suspended solids - and also general observations at the time of measurement.

Deep man-made lakes in New South Wales are often turbid because of the entry of floodwaters. During the time taken for this turbidity to clear, the algal productivity may still be high, although confined to a thin surface layer.

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THE DEROGATION OF THE DELECTABLE DUNE LAKES OF NORTH EASTERN N.S.W.*

By B.V. TIMMS

(Avondale College, Cooranbong, N.S.W.)

Man finds dune lakes enjoyable and useful for aesthetic, recreational, educational and scientific reasons. Of the 8 types of freshwater dune lakes recognisable on geomorphic, chemical and biological criteria, 5 are found in northeastern N.S.W., the greatest diversity for any area in eastern Australia.

Of the 16 lakes/pond groups under study, 2 (Belmont Lagoon, Redhead Lagoon) are adversely affected by drainage, 2 by the introduction of Mosquito Fish (Redhead Lagoon and Lake Ainsworth), 1 (Lake Ainsworth) by urbanization and recreation, 1 (Taylor's Lake) by past mineral sand mining, 4 (Myall Lake swamps, Blue Lagoon, ponds near Blue Lagoon, Broomes Head Swamp) by present or future

sand mining, 4 by minor developments such as water supply schemes (e.g. Lake Hiawatha) or use as a bombing range (e.g. Cook's Lagoon), and only 4 (Freshwater Lagoon, Myall Lakes N.P., and three in and near Red Rock N.P.) are in a pristine condition.

In all, although half of the lakes are relatively safe, only two of the five types are conserved in National Parks. Should sand mining in national parks be banned then almost three-quarters are relatively safe and all of the 5 types are represented in the National Estate.

*A modified and updated text of this paper will appear in *Hunter Natural History* later this year.

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WELCOME REEF DAM ENVIRONMENTAL IMPACT SURVEY, SHOALHAVEN RIVER SYSTEM

By K.A. BISHOP

(C/- N.S.W. State Fisheries)

The aquatic fauna of the Upper Shoalhaven Catchment, N.S.W., was examined over a 15-month period (November 1975 to January 1977) during a pre-impoundment survey for the Second Stage of the Shoalhaven Scheme. The biology of lotic populations of Macquarie Perch *(Macquaria australasica)* and *Galaxias olidus* were studied in detail. The seasonal diversity and abundance of aquatic macro-invertebrates were also examined within the catchment.

Brown trout *(Salmo trutta)* were found to co-exist with the above native species though summer water temperatures limited trout distribution and abundance in the river system. Following impoundment of the river it is anticipated that the future survival of the existing Macquarie perch population will be threatened as: (a) the perch population will suffer a 50% reduction of lotic spawning sites following river inundation, and (b) following establishment of a lentic trout population it is anticipated that the perch population will be displaced by lotic invading trout through competitive and predation interactions.

A policy to protect the lotic population of Macquarie perch is proposed by the creation of a lotic reserve protected from the invasion of lentic trout.

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THE IMPACT UPON THE FISH FAUNA OF RIVER FLOW STOPPAGES BELOW TALLOWA DAM, SHOALHAVEN RIVER, N.S.W.

By K.A. BISHOP and J.D. BELL*

(*Presented by J.D. Bell,
N.S.W. State Fisheries)

During November and December 1976 observations were made on several fish kills below Tallowa Dam on the Shoalhaven River in N.S.W. Large numbers of fish died on each of four separate occasions when the flow of water below the dam was terminated.

Under normal operating conditions, a fairly consistent flow (approximately 45 m^3/sec) is maintained through one of two dam outlets. Fish died on each occasion when the outlet was closed (over a period of approximately 15 minutes), and river flow dropped rapidly so that within 40 minutes the river was reduced to a dry bed. Although a series of isolated pools was initially established, most of these drained rapidly through the loose shingle substrate of the river bed, thus leaving large numbers of fish stranded. Fifteen fish species were recorded from the immediate area below the dam; however, a complete count of the number of each species was not possible due to a lack of time and manpower. The number of fish killed varied with each termination of flow.

On the 29.11.76 a large school of approximately 300 Australian grayling *(Prototroctes maraena)* was stranded and killed. The initial occurrence of large numbers of this species in the area was of particular interest as this fish is probably the Australian freshwater fish most seriously threatened with extinction. (Its closest relative is almost certainly already extinct in New Zealand.)

Smaller species like smelt and gudgeons were particularly affected, and up to 270 specimens were found in some places on the dry riverbed.

Guidelines for the maintenance of water flow below the dam during future construction and maintenance work and for the conservation of fish species threatened by the dam, e.g. grayling and bass *(Percalates novaemaculeatus)*, were suggested.

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THE BIOTAS OF NORTH QUEENSLAND RIVERS AND THE HAZARDS CONFRONTING THEM

By R.G. PEARSON

(James Cook University, Queensland)

This paper briefly describes a survey that is being undertaken to ascertain the effects of sugar mill effluent on North Queensland streams. It is shown that some streams are affected by the organic and/or heated effluents: diversity and abundance of plants and animals are reduced and in some cases a biota typical of polluted waters (with fungus, Oligochaeta and Chironomidae predominating) is to be found downstream of effluents. After the end of the crushing season (December) rapid recovery of much of the fauna occurs, but this is stemmed by the onset of the wet season, the effects of which can be gross removal of the biota. Following the wet season, recovery is again rapid until the crushing season resumes (June). Recovery from the effects of pollution is facilitated by movements of the fauna from upstream, whilst recovery after the wet season must be affected by populations which survive in backwaters and flooded areas. The instability of these streams may partly account for the predominance of highly mobile animals (e.g. *Macrobrachium* spp. and Atyidae).

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MINING POLLUTION AND THE DIET OF THE GUDGEON MOGURNDA MOGURNDA

By R.A. JEFFREE and N.J. WILLIAMS*

(*Presented by N.J. Williams,
A.A.E.C. Research Establishment)

The perennial Finniss River of the Northern Territory receives via its seasonal East Branch a pollutant load (mainly of transition elements, acidity, and sulphate) from the mined area of Rum Jungle. Previous work has indicated delineation of polluted and unpolluted zones of the Finniss River. Collections of *Mogurnda mogurnda* were taken during the Dry season from shallow sites in both *a priori* polluted and unpolluted zones. Thirty-nine mutually exclusive categories of foods were eaten of which 19 occurred sufficiently widely and often for statistical comparison of the zones. Adjustments were made for the effect of size of fish on diet. The diets of the collected fish could be categorized by taking random samples of 20

from each collection and adjusting the numerical abundances of dietary items for the influences of season, habitat structure, and presence of other fishes. Hierarchical agglomerative analysis on all 19 foods showed a general clustering of diets from the unpolluted zone, with a wider scattering of diets from the polluted zone. When foods were divided between those obtaining dissolved oxygen with no intervening gas film, and atmospheric or bubble breathers, the former group yielded a dendrogram which more clearly separated the zones.

The successive elimination of foods which masked the *a priori* zonal division yielded a reduced set of 14 foods which may be regarded as a package of indicator species in the diet. The elimination of additional foods did not improve the dendrograms with respect to the *a priori* zonal classification. A single iteration was performed using the resistant dendrogram as an 'improved' classification; this interpretation was supported by known local conditions observed at the times of collecting the fish originally. As before, adjustments were made to dietary composition based on the *de novo* unpolluted collections. New dendrograms were derived which clearly distinguished the *de novo* groups of collections. Collections from a perennial unpolluted tributary stream fell with the *de novo* unpolluted group. Work is proceeding to quantify the contributions made by the types of foods towards predicting polluted/unpolluted differentiation along a linear scale.

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SCIENTIFIC ARTICLE NOT DELIVERED AT A CONGRESS

PHOLETEROS - THE FAUNAL ASSEMBLAGE FOUND IN CRAYFISH BURROWS

By P.S. LAKE

(Department of Zoology, Monash University, Clayton, Victoria)

In Tasmania, "land" crayfish of the genera *Engaeus* and *Parastacoides* are to be found in most of the wetter parts of the island. The typical structure of the burrows of the crayfish *Parastacoides tasmanicus* has been described by Lake and Newcombe (1975) while that of two species of *Engaeus* has been described by Suter and Richardson (1977). In the case of *Parastacoides tasmanicus* and of *Engaeus fossor* the burrows reach the water table while in the case of a new species *Engaeus cisternarius* (described by Suter 1977), the burrows do not reach the prevailing water table, yet water is to be found in the burrows.

Examination of the burrows of *Parastacoides tasmanicus* has revealed an assemblage of animals dwelling in the burrow water (Lake and Newcombe 1975, Lake and Coleman, in press). A provisional list of animals found in the burrow water was given by Lake and Newcombe (1975). To date the animals found in the burrow water are all crustaceans though it can be expected that future collecting will reveal such groups as protozoans, oligochaetes, insects, nematodes.

TABLE 1. Animals of the Pholeteros in the burrows of *Parastacoides tasmanicus* (adapted from the Table in Lake and Newcombe 1975)

CLASS CRUSTACEA

Subclass Copepoda

Order Cyclopoida

Acanthocyclops n.sp.(1)

Superorder Syncarida

Order Anaspidacea

Micraspides calmari
Allanaspides helonomus
Allanaspides hickmani

...../(over)

Superorder Peracarida

Order Isopoda

Suborder Phreatoicidea[2]

Phreatoicoides spp.
Hypsimetopus intrusor
Uramphisopus binksi
Uramphisopus australis

Suborder Asellota

Family Janiridae

Two species. *Pseudasellus* sp. and possibly *Heterias* sp.

Order Amphipoda

Neoniphargus (four species?)
"Niphargus" sp.
"Gammarus australis"
Paracalliope fluviatilis
Paraleptamphopus sp.[3]

Notes: (1) This species is currently being described by Mr. D. Morton, Zoology Department, Monash University, Clayton, Victoria, 3168.

(2) The phreatoicids have recently been revised by Knott (1975) and the names are those used in his thesis.

(3) This species of *Paraleptamphopus* was described by Coleman (1975) in his Honours thesis.

As it is felt that such a habitat is a distinctive one with its own particular physico-chemical features in comparison with neighbouring surface waters, the term Pholeteros has been coined to identify the assemblage of animals found in the burrow water (Lake and Coleman, in press). Pholeteros comes from the Greek word *Pholeter-os* - "one who lurks in a hole". At present it appears that no animal species is only to be found in this assemblage.

The first record in Australia of aquatic animals occurring in the burrows of crayfish appears to be by Nicholls (1931). He collected the syncarid *Micraspides calmani* from water in the burrows of *"Engaeus"* near Queenstown and Mt. Heemskirk on the west coast of Tasmania. While *Engaeus* is known to occur in this region (Suter and Richardson 1977), it is most likely that the burrows in which *M. calmani* was collected belonged to *P. parastacoides* (Lake and Coleman, in press). *Koonunga*, a syncarid in the same family as *M. calmani*, the Koonungidae, has also been recorded in the burrow water of crayfish (Drummond 1959). Other syncarids to be found in the pholeteros are the two recently described species *Allanaspides helonomus* and *Allanaspides hickmani*.

The burrows of species of *Engaeus* do not appear to be as rich as those of *Parastacoides* in pholeteros. Suter and Richardson (1977) recorded blind amphipods in burrows of *Engaeus cisternarius* and janirid

isopods *Pseudaselluss* sp. in burrows of *Engaeus fossor*.

The water of the burrows of *Parastacoides tasmanicus* is characterised by its acidity (e.g. pH = 4.4), its relatively low amounts of major ions, and its deep brown colour (suggestive of a high organic content) (Lake and Newcombe 1975). Very low oxygen concentrations were also recorded in summer in burrow water of *Engaeus* (Suter and Richardson 1977). Thus the burrow water of "land" crayfish is a relatively difficult aquatic environment for animals to adapt to and inhabit.

Lake and Newcombe (1975) suggest that the animals found in the pholeteros in south-west Tasmania have adapted to the subterranean existence of crayfish burrow water in order to survive the dry conditions of summer when many of the shallow pools of water in the button grass swamps dry up.

Pholeteros has also been recorded in North America (Creaser 1931, Williams, Williams and Hynes 1974). Creaser (1931) recorded ostracods, copepods, and amphipods from the burrow water of *Cambarus diogenes* in the Missouri Ozark Mountains. He suggested that this fauna may populate temporary pools when the ponds fill, as well as lead to "the establishment of a subterranean crustacean fauna ....". In the burrow water of *Cambarus fodiens* in Ontario, Canada, Williams, Williams and Hynes (1974) found protozoans, nematodes, oligochaetes, larval chironomids, adult Collembola, ostracods, cyclopoid and harpacticoid copepods, and amphipods. This fauna survives in the crayfish burrows when the nearby stream dries up and the burrows may thus act as refuges for the stream fauna.

All the reports of pholeteros so far list crustaceans as being the dominant group of animals. This may be because the crustaceans in question have not evolved effective methods of drought resistance and have adopted a strategy of drought evasion in spite of the stresses imposed on them by the burrow water environment. As suggested by Creaser (1931) and Nicholls (1946), the crustaceans in the pholeteros may also represent an intermediate step between surface water dwellers and subterranean water dwellers.

In Australia with such a relatively rich fauna of "land" crayfish, examination of pholeteros can be expected to yield most interesting animals, especially crustaceans.

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